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Metals Review

THE NEWS DIGEST MAGAZINE

RAY T. BAYLESS, Publishing Director — MARJORIE R. HYSLOP, Editor — GEORGE H. LOUGHNER, Production Manager

VOLUME XXII, No. 6 — **June, 1949**

A.S.M. REVIEW OF METAL LITERATURE

ORE BENEFICIATION AND RESERVES 21
Preparation and Concentration; Ore Resources

SMELTING, REDUCTION AND REFINING 22
(Including Electrolytic Refining)

PROPERTIES 23
Physical, Mechanical and Chemical

CONSTITUTION AND STRUCTURE 27
Metallography, Constitution Diagrams, Crystal Structure

POWDER METALLURGY 29
Processes and Products

CORROSION 29
Theory, Measurement, Prevention (Except Coatings)

CLEANING AND FINISHING 31
Chemical and Mechanical; All Types of Coatings Except Electrodeposited

ELECTRODEPOSITION AND ELECTROFINISHING 33
(Plating, Electropolishing, Electroforming)

PHYSICAL AND MECHANICAL TESTING 34
(Including Stress Analysis)

ANALYSIS 35
Qualitative and Quantitative; Identification Methods

APPARATUS, INSTRUMENTS AND METHODS 37
Industrial Measurement and Control (Except Temperature); Laboratory Equipment and Procedures

INSPECTION AND STANDARDIZATION 39
(Including Quality Control, Radiography, Specifications)

TEMPERATURE MEASUREMENT AND CONTROL 40

FOUNDRY PRACTICE 40
Methods and Equipment (Except Furnaces)

SCRAP AND BYPRODUCT UTILIZATION 42

FURNACES AND HEATING DEVICES 42
(Including Induction and Resistance Heating Equipment)

REFRACTORIES AND FURNACE MATERIALS 43

HEAT TREATMENT 44
(Including Flame Hardening, Induction Heating, Cold Treatment)

WORKING 45
Rolling, Drawing, Forging, Stamping and Presswork, Shot-Peening

MACHINING 47
(Including Tools, Machinability and Cutting Fluids; Excluding Flame Cutting)

MISCELLANEOUS FABRICATION 49
General Manufacturing and Assembly Procedure; Plant Operations; Materials Handling

JOINING AND FLAME CUTTING 50
Welding, Brazing and Soldering

APPLICATIONS 52
General and Specific Uses of Metals

DESIGN 53
Metallurgical Factors in Design of Parts, Equipment and Structures

MISCELLANEOUS 54
(Including Research, Lubrication and Friction; Other General and Unclassified Subjects)

SPECIAL FEATURES

Metals for High Temperature Service, by Ward F. Simmons and A. B. Westerman 5

A. S. M. National Officers Nominated for 1949-50 ... 9

IMPORTANT LECTURES

Service Tests Are Ultimate Proof of Adequate Design—H. B. Knowlton 10

Sauveur Lecturer Relates Martensite Transformation to Nucleation Theory — John H. Hollomon 13

Unique Materials Developed in Bell Telephone Laboratories—J. R. Townsend 14

Explains Microstructure in Terms of Topology — Cyril Stanley Smith 15

Significance of Carbon Content in 18-8 Shown—Russell M. Franks 16

Wide Selection of Toolsteels Insures Maximum Efficiency—C. K. Baer 18

Recent Innovations in Steelmaking—Bradley Stoughton 20

DEPARTMENTS

The Reviewing Stand 11
Honor Roll of the Well-Informed 12
Thirty Years Ago 13
Compliments 20
Manufacturers' Literature 57
Reader Service Coupon 57
Employment Service Bureau 58
Quarter-Century Club 59
New Products in Review 60-63
Advertisers' Index 63

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio; Harold K. Work, President; Arthur E. Focke, Vice President; William H. Eisenman, Secretary; E. L. Spangel, Treasurer; E. G. Mahin, C. M. Carmichael, F. J. Robbins, Harry P. Croft, Trustees; Francis B. Foley, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930, at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

Claims for missing numbers will not be allowed if received more than 60 days from date of issue. No claims allowed from subscribers in Central Europe, Asia, or the Pacific Islands other than Hawaii, or because of failure to notify the circulation department of a change of address, or because copy is "missing from files".

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1. In stress-rupture tests at 1500° F., which of the various high-temperature alloys (superalloys) proved to be the strongest?
   - (a) The cast cobalt-base alloys of the Vitallium type.
   - (b) The wrought alloy known as Refractaloy 26
   - (c) The various Inconel alloys
   - (d) The British alloy Nimonic 80

   Answer found on page ——.

2. What metal possesses unique electrical properties that have made possible the manufacture of miniature radio devices?
   - (a) Tungsten
   - (b) Thorium
   - (c) Titanium
   - (d) Germanium

   Answer found on page ——.

3. What is the principal advantage of a new aluminum alloy designated 150S?
   - (a) Excellent resistance to salt water corrosion.
   - (b) Better strength and finish than provided by the older alloys 2S and 3S.
   - (c) Lower cost of the material as compared to 3S or 52S.

   Answer found on page ——.

4. Which of the following identifies the man nominated for vice-president of the American Society for Metals in 1949-50?
   - (a) Steel consultant in Cleveland, formerly with U. S. Steel Corp.
   - (b) Inventor of a hardness testing machine
   - (c) Staff engineer for one of the large automobile companies
   - (d) Director of research for a manufacturer of toolsteels

   Answer found on page ——.

5. What expedient is used in milling to give faster cutting speeds with good tool life and reduced power requirements?
   - (a) Machining at temperatures of 1000 to 1500° F.
   - (b) Use of a special fixture in the form of a caster-roll swivel bracket
   - (c) Use of tallow grease as a lubricant
   - (d) Designing the cutter with a back-off curve based on wanted profile and shaving surface.

   Answer found on page ——, item No. ——.

6. How can a thin, clean and tenacious oxide film be produced on many metal surfaces by heat treatment?
   - (a) By heating in a commercial controlled atmosphere known as Type TV
   - (b) By processing in steam at temperatures up to 1000° F.
   - (c) By a special salt bath tempering process
   - (d) By cooling in a stream of pure oxygen.

   Answer found on page ——, item No. ——.

7. What new outlet for metals is developing in the agricultural field?
   - (a) Pipe and flumes for irrigation projects in the Pacific Northwest
   - (b) Increasing use of stainless steels for farm implements
   - (c) Aluminum roofing and siding for barns and silos
   - (d) Incorporation of minerals in fertilizer and livestock feed

   Answer found on page ——, item No. ——.

8. What method is recommended for increasing production of finished steel?
   - (a) Practices that decrease loss in material and time between ladle and finished products.
   - (b) Expansion of existing plant facilities
   - (c) Building and relocating of new plants
   - (d) Installation of modern continuous rolling mills

   Answer found on page ——, item No. ——.

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Metals for High Temperature Service

A Review of Recent Literature

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By Ward F. Simmons and A. B. Westerman
Battelle Memorial Institute

AUSTENITIC stainless steels have been known since early in this century, but the high-strength, heat resisting alloys which evolved from them are relatively new. The impetus behind the wartime research on these alloys was the need for better materials for turbosuperchargers, and later for gas turbines in jet engines.

While specific values are given for the various properties of the different alloys, the literature points out again and again that other factors besides composition exert a considerable influence upon the properties. Under certain conditions manufacturing variables may be more important than chemical composition.

The present article will review the previous year's literature in some detail, and will also include a few of the outstanding references appearing between 1945 and 1948.* The type compositions of the various high-temperature alloys are shown in the table on page 8.

High-Strength Heat Resisting Alloys

The results of extensive wartime research on the so-called "superalloys", carried out for the Office of Scientific Research and Development and the National Advisory Committee for Aeronautics, have been summarized by the American Society for Testing Materials in a "Symposium on Materials for Gas Turbines" (3-470, 3-471, 3-474, 1947*).

The alloys were generally evaluated by high-temperature tensile tests, stress-rupture tests, and creep tests. In stress-rupture tests at 1500° F. (3-470, 1947) the cast cobalt-base alloys of the Vitallium and modified Vitallium types had higher strengths than the wrought alloys. The strongest cast alloys were X-40, 422-19, S-816, and 61, and the strongest wrought alloys were Refractaloy 26, S-816, N-155, and S-590. The best cast alloys had a 100-hr. rupture strength between 25,000 and 32,000 psi. and a 1000-hr. rupture strength between 20,000 and 26,000 psi. The best wrought alloys showed rupture in 100 hr. between 19,000 and 26,000 psi., and in 1000 hr., from 15,000 to 18,500 psi.

In creep tests at 1500° F. the cast alloys X-40 and 422-19 gave the best performance, with a stress of 11,000 to 12,000 psi. producing a creep rate of 0.00001% per hr. Refractaloy 70 was the best of the forged alloys, with 0.00001% per hr. at about 11,000 psi. However, at the time these tests were made, this alloy could not be made consistently with these high properties. All other forged alloys were below 10,000 psi. for a creep rate of 0.00001% per hr. On the other hand, when the cast and forged alloys were compared on the basis of stress to produce low values of total deformation (0.2%), the forged alloys were superior.

In stress-rupture tests at 1600° F. the best alloy was cast X-40. For a 100-hr. rupture time all forged alloys were below 15,000 psi., while the cast alloys were above 15,000, and up to 20,500. For 1000 hr. rupture time, the cast alloys ranged from 10,000 to 18,000 psi., while the forged alloys were below 10,000.

Also in creep tests at 1600° F. the cast cobalt-base alloys were better than the forged alloys. Cast 422-19 alloy had the best creep properties, with a rate of 0.00001% per hr. at about 9500 psi.

In stress-rupture tests at 2000° F. on the better cast cobalt-base alloys, rupture occurred in ½ to 1 hr. at about 10,000 psi., and in 100 hr. at 4000 to 5000 psi.

In the lower temperature range of 1200 to 1350° F., the forged alloys compared more favorably with the cast alloys. At 1350° F. the better forged alloys, as a group, had even better creep resistance than the cast alloys.

Of the alloys exhibiting outstanding strength properties at 1200° F. Timken 16-25-6, N-155, .19-9DL, age-hardenable Inconel (Inconel W), S-590, and S-816 have commercial potentialities (3-474, 1947).

Superior strength at 1200° F. can be produced by hot-cold working after a solution treatment, but this procedure generally causes low ductility in the rupture tests. Furthermore, this superior strength is not retained indefinitely at 1200° F. The hot-cold worked materials usually have better load-carrying ability under high stress and for short times, while annealed materials are better under low stress for long periods. The time period at which the solution-treated condition is best varies for different materials, but is generally longer than 1000 hr.

The superalloys, by virtue of their high-temperature strength, are difficult to hot work and also to hot-cold work in the range from 1200 to 1700° F. Most of them are considerably more difficult to machine and to weld than ordinary steel.

Fatigue strength of the heat resisting alloys at 1200 and 1500° F. has been investigated by Toolin and Mochel (3a-31, May 1948). Their tests were made by bending under completely reversed stress at 120 cycles per sec. One of the better materials at both temperatures was S-816 alloy, with a fatigue strength at 100 million cycles of 70,000 psi. at 1200° F., and 47,000 psi. at 1500° F. These values are considerably above the stresses to produce rupture in 100 hr. in constant-stress rupture tests.

The wrought form of a given alloy appears to have higher fatigue strength at 1200 to 1500° F. than does the precision-cast form. Other factors besides composition exercise a considerable effect upon fatigue strength.

In the selection of materials for high-temperature service, it should be emphasized that strength is not the whole story. Rebecca Smith (23a-8, March 1948) states that the factors governing the selection of materials for gas turbines are both metallurgical and economic, and may be influenced by the scarcity of strategic elements. When metallurgical demands for strength, oxidation resistance, and stability are satisfied, ease of fabrication, cost, or availability may well dictate the choice. Sometimes it is wiser to design to easily available material so as to conserve stocks of strategic metals.

*Literature references are cited by the corresponding item number in the Review of Current Metal Literature instead of repeating the entire title, author, and source; this information can be obtained by referring to *Metals Review* for the month indicated, or the 1947 bound volume of the A.S.M. Review of Metal Literature (Volume 4).

Forged Disks

A recent paper (3A-52, April 1949) includes all of the wartime work of the N.A.C.A. and O.S.R.D. on large forged rotor disks for gas turbines, and also the most recent work of the N.A.C.A. and the Office of Naval Research. High-temperature tests were made on 24 large forged disks of eight heat resisting alloys. The materials ranged from relatively low alloys such as 16-25-6, CSA, EME, and 19-9DL through the more highly alloyed materials such as low-carbon N-155, S-590, S-816, and Inconel "X". Short-time tension, rupture, creep, and stress-time for total deformation characteristics were determined at 1200, 1350, and 1500° F.

At 1200° F. the variations in properties of the various alloys are such that tensile load-carrying ability would be much the same for all of the alloys (Except S-816 and Inconel "X") with proper control of processing and treatment. The less highly alloyed materials, particularly when hot-cold worked, have comparatively low load-carrying ability at 1350 and 1500° F. The relative strengths at 1350 and 1500° F. of low-carbon N-155, S-590, and S-816 disks are largely dependent on heat treatment. Alloy S-816 and Inconel "X" have greater load-carrying ability at 1200° F. than the other disk materials. Their degree of superiority decreases at 1350° F. At 1500° F. the differences in strength between the more highly alloyed materials are relatively minor and are dependent on treatment. Inconel "X" shows entirely different behavior from the other alloys in that the transition point at which third-stage creep begins occurs at short testing time and low total deformation.

Fonda, discussing the forging and testing of rotor disks for gas turbines (9a-59, Sept. 1948), again points out the importance of proper control of manufacturing variables, and the necessity for having sound ingots to produce sound forgings. In bursting tests on 179 turbine wheel blanks it was found that the center rather than the rim is the critical area. The quality of the center is difficult to control in a large forging. Good ductility of the alloy is the best insurance that minor defects or discontinuities will not materially affect the bursting speed of the wheel.

Experimental Cast Alloys

Chromium-base alloys, because of their high melting point and other promising high-temperature properties, have been selected for further study (3-471, 1947). Composition range is 60% chromium, 15 to 25% iron, 15 to 25% molybdenum with slight modifications. The stress to produce rupture in 100 hr. at 1600° F. is 42,000 psi. and in 1000 hr. 38,000 psi. This is a significant increase in rupture strength over the cobalt-base alloys, but there are still many difficulties to be overcome before the chromium-base alloys will see commercial service.

Grant (9-100, 1947) has studied the effect of casting temperatures and mold temperatures on the stress-rupture properties of a modified high-carbon Vitallium-type alloy. Grain size increases as metal and mold temperatures increase; the carbide spacing increases with increasing mold temperature, but remains constant with increasing metal temperature. High-temperature strength is dependent on grain size and hot ductility on carbide spacing. The rupture strength increases with larger grain size, but only a few grains or a single grain in a section may give poor rupture strength depending on their orientation.

Grant also reports a new cast alloy designated "J" alloy, developed from Vitallium as a starting point (3-247, 1947). The high carbon content (about 0.76%) is responsible for a lower room-temperature ductility than is desired by gas-turbine manufacturers. However, the designers cannot have their cake and eat it too, since any significant increase in high-temperature strength usually is at the expense of ductility. The reported 100-hr. rupture strength for "J" alloy at 1500° F. is 35,000 psi., and for 1000 hr. about 28,000 psi.

A new group of cast nickel-base alloys contains 6% aluminum and 6% molybdenum, as well as chromium, boron, and columbium (3c-78, November 1948). The tensile strength of an alloy with 12 to 15% chromium was 140,000 psi. at room temperature and 100,000 psi. at 1500° F. The 100-hr. rupture strength at 1500° F. for some of these alloys reaches 50,000 psi., and the 1000-hr. rupture strength 30,000 psi. They also have good oxidation resistance and moderate fatigue strength. Compared to cobalt-base materials, they have low elongation and impact resistance. These alloys are also difficult to melt because of the high aluminum content.

British Alloys

Among the British alloys, William Jessop and Sons' G.18B (3b-3, Feb. 1948 and 3b-186, Jan. 1949) is probably most used for turbine rotors, and to some extent for blades. At 1500° F., G.18B has a 100-hr. rupture strength of about 26,800 psi. and a 1000-hr. rupture strength of about 11,600 psi. At 1200° F. its 1000-hr rupture strength is 35,800 psi. An unusual property of G.18B is that at 1290° F. its ductility increases with time in rupture tests. Elongation at rupture in 20 hr. is about 7% and in 3000 hr. 15%. A new Jessop alloy G.32 with a higher cobalt content has a creep strength at 1380° F. about 75% higher than G.18B.

R.22 alloy, which is more scale resistant but weaker at high temperatures than G.18B, is used for inlet-nozzle blades at temperatures up to 1650° F.

For some years the standard turbine-blade material used in almost all British gas turbines has been Nimonic 80 (23-496, 1947). This alloy has a 1000-hr. rupture strength of 50,000 psi. at 1200° F. and about 14,000 psi. at 1500° F. Nimonic 80 has low ductility as measured in rupture tests, but it is consistent and dependable.

The British do not believe that ductility as measured in rupture tests is significant in evaluating a material for blade service. Photographs were shown of Nimonic 80 blades which were almost rolled up by impact of some foreign matter coming through the turbine; this indicated that the blades were ductile when subjected to high-speed impact at operating temperatures.

British research on blade materials has continued and new Nimonic-type alloys are now available in experimental amounts.

Sheet

Freeman, Reynolds, and White (3a-24, April 1948) made rupture tests at 1700 and 1800° F. on five commercial heat resisting alloys, four standard stainless steels, and four experimental alloys (nickel-chromium base with cobalt, molybdenum, tungsten, and boron) in sheet form. In general, at 1700° F. the high-temperature alloys were outstandingly stronger than the stainless steels; this degree of superiority diminished as the rupture time increased. Similar trends were evident at 1800° F., but the time period for equalizing rupture strengths was shorter than at 1700° F. Vitallium, S-590, and low-carbon N-155 alloys were the strongest of the available materials for rupture times up to 1000 hr. at both temperatures. The rupture strengths for failure in 10, 100, and 1000 hr. at 1700° F. ranged up to 12,000, 8000, and 3900 psi. respectively. The corresponding strengths at 1800° F. were 8600, 4200, and 1850 psi.

It was pointed out that the rupture-test properties depended on the strength of the matrix, the processing and heat treatment, and the structural and surface stability of the alloys under the test conditions. For the high-temperature alloys, the cast form is generally the strongest, bar stock intermediate, and sheet the weakest. In service the sheet properties might be considerably different depending upon the atmosphere to which it is exposed.

Although oxidation resistance, low creep rate, and strength at elevated temperatures are important, for locally heated sheet thermal conductivity and expansion are more critical than is commonly realized (3a-109, Nov. 1948). Little has been pub-

lished of the extensive work done on the development and application of sheet for gas-turbine exhaust stacks and combustion chambers. Yet, since low thermal conductivity and high thermal expansion are characteristic of available heat resisting alloys, thin sheet sections are particularly susceptibile to the harmful effects of localized heating and flame impingement (buckling, warpage, and failure from thermal stress gradients); consequently, they are a prolific source of trouble in turbosuperchargers.

The inadequacies of the common laboratory tests (such as stress-rupture and creep) in completely evaluating materials, particularly in sheet form, for service over wide temperature ranges have emphasized the need for testing under simulated service conditions. Haythorne, (3a-109, Nov. 1948) studied the effect of repeated flame impingement on the resistance to warpage, buckling, and ultimate cracking. The test materials included several high-temperature alloys and stainless steels—some with electrodeposited coatings—and a few composite materials.

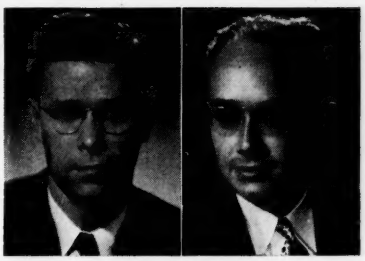
For the impingement test one end of a rotating tubular specimen was heated locally to about 1500 to 2000° F. for 5 min. and cooled in still air for 1 min. Heating and cooling were alternated until circumferential cracking occurred.

Inconel-clad copper ranked highest (1100 cycles to failure); Vitallium, S-816, and Inconel-clad nickel next (250 to 500 cycles); and Inconel, Hastelloy C, 19-9 W-Mo, 19-9 DL, Inconel "X", and the stainless steels last (50 to 150 cycles to failure). Electrodeposited coatings helped slightly, but these beneficial effects would be quickly obviated in service because of poor adhesion; oxidation, blistering, and scaling; and the thermal-expansion difference between the base and the plate. Clad materials showed promise. Inconel-clad copper and nickel particularly might offer the optimum combination of properties needed for many high-temperature sheet-metal applications.

The severe temperature gradients are the primary source of warpage, buckling, and cracking with no load factor involved other than that imposed by self-support. Relatively insignificant improvements in thermal conductivity would therefore substantially inhibit distortion and failure.

Welding

As a result of wartime restrictions, little has been published on the welding characteristics of high-temperature alloys. In general, they can be welded to each other or to dissimilar alloys by all of the methods used on austenitic stainless steel (22a-27, March 1948; 22-783, 1947). Like the stainless steels, they have higher electrical resistance, higher coefficients of expansion, higher mechanical strength at elevated temperatures, narrower ranges in which they are plastic, and lower thermal conductivity than low-carbon steel. Consequently, properly designed jigs and fixtures, particularly for welding sheet and plate, proper sequence of welding, and accurate fitting and edge preparation are essential in producing satisfactory weldments.



The Authors, Ward F. Simmons (Left) and Arthur B. Westerman (Right), Are Both on the Staff of Battelle Memorial Institute as Engineers on High-Temperature Materials Research

Metal-arc welding is especially fast and accurate. The joint designs established for stainless steels are acceptable for the high-temperature alloys, and austenitic stainless steels are generally used as filler metal.

In spot, stitch, and seam welding of a nickel-base alloy (22a-1, Feb. 1948), higher pressure, lower current, and longer heating and forging times should be used than for mild steel; if possible, the sheet should be in the annealed condition prior to welding. Short heating and forging times will give a strong weld, but blowholes will occur in the center of the weld. Surface marking and cyclic strength irregularity resulting from heat buildup, can be reduced by directing a stream of water on the workpiece.

One of the most difficult problems is attaching buckets to turbine wheels because of the radial cracking that starts at the interbucket junctions and propagates across the weld. A weld test specimen simulating a wheel-and-bucket assembly was developed by Linnert (22a-190, Oct. 1948). Combinations of nine alloys as bucket materials, five as wheel materials, and five as filler metal, were welded using the submerged-arc and manual metal-arc methods. The amount of radial cracking in the weld deposit was then measured. Interbucket junction cracks were the most prevalent defects. These varied in length up to about ⅜ inch (almost halfway across the weld), depending upon the alloy combination.

In order of increasing susceptibility to cracking, the ranking of the bucket materials was Timken 16-25-6, Hastelloy B, Vitallium, 422-19, 6059, S-816, and X-40; this was practically the same for submerged-arc and metal-arc welding using 16-25-6 or 19-9 DL alloys as wheel materials and Type 316 electrodes (18% Cr, 12% Ni, 2.5% Mo).

Cracks in submerged-arc deposits were longer than in manual-arc welds, especially where the alloy combinations were susceptible to cracking; the more insensitive combinations showed little difference. Wide submerged-arc beads with tapering sides cracked more severely than narrow beads with straight sides.

Preheating at 300 to 1000° F. had relatively little influence on the severity of cracking in 16-25-6 to S-816 (wheel-to-bucket) tests welded by both methods with Type 316 electrodes.

Timken 16-25-6 to S-816 wheel-to-bucket specimens were welded with Type 316 and Hastelloy B electrodes. No differences in cracking were found for manual-arc welded specimens; all of the values were low. In the submerged-arc welded specimens, the Type 316 alloy deposit cracked severely and the Hastelloy B weld surprisingly little.

In an all-S-590 alloy specimen, the use of rhombic buckets with sides slanted at 45°, instead of normal rectangular buckets with vertical sides, markedly reduced cracking in the manual-arc weld, but not in the submerged-arc weld.

Weld metals with primarily austenitic structures had practically no susceptibility to cracking, but those with small, interdendritic complex carbides, and possibly other compounds, were susceptible. These compounds tended to segregate as pronounced stringers in the weld at interbucket junctions, and favored the propagation of severe junction cracks. The major factor affecting sensitivity to junction cracking appeared to be the susceptibility of weld metal to the development of segregates. The amount and distribution of such segregates are probably functions of weld composition and cooling rate. Difficulties in determining the weld compositions precluded the correlation of composition with susceptibility to segregation.

Structure

During the development of most of the high-temperature alloys, there was little time for a systematic study of the structures, and little is known about the phases present in even the more widely used alloys. However, a certain amount of information is available.

The prominent high-temperature iron-base alloys (such as Timken 16-25-6, 19-9 DL, and S-590), nickel-base alloys (such as Hastelloy B and Nimonic 80), and cobalt-base alloys (such as Vitallium, S-816, and X-40) have structures consisting of austenitic matrices and precipitated compounds; the latter are presumably carbides and nitrides of chromium, molybdenum, tungsten, columbium, and titanium, depending upon the

composition of the alloy (4a-28, Aug. 1948).

The precipitated compounds increase the high-temperature strength and lower the high-temperature ductility, especially in coarse-grained alloys, and appear to enhance the hot notched-bar impact strength, regardless of grain size. If the mode of precipitation of these compounds and the grain size could be controlled simultaneously, a stable structure that would retain its mechanical properties at high temperatures could probably be produced.

Efforts are being made to identify some of the precipitated compounds. As the first step in the study of Vitallium, Elsea, Westerman, and Manning (4c-42, Aug. 1948) developed the cobalt-chromium equilibrium diagram. The alpha-beta transformation (high-temperature, face-centered cubic phase to low-temperature, hexagonal close-packed phase in the cobalt-rich solid solution has been accurately located. For 20 to 32% chromium (the chromium:cobalt ratio of Vitallium) the transformation temperature ranges occur at about 1500 and 1700° F.—temperatures at and above the present maximum operating level. A hard, brittle compound, gamma, was found at approximately 53 to 58% chromium; this is isomorphous with sigma phase of the iron-chromium system (4C-21, May 1948). The beta-plus-gamma field extends into the pertinent chromium range; the presence of the compound there probably has some effect on the high-temperature properties of Vitallium.

As in austenitic stainless steels, variable amounts of delta ferrite may be present in the austenitic matrices of the high-strength, high-temperature alloys; its occurrence depends upon the balance between the ferrite-forming and the austenite-forming elements present in the alloys and upon processing and heat treatment. The delta ferrite can be converted to sigma phase during heat treatment.

Gilman, Koh, and Zmeskal (4b-77, Nov. 1948) investigated delta ferrite formation and its influence on sigma formation in the 19-9 DL alloy. In the original hot-cold rolled condition, this alloy showed precipitated particles (carbides and nitrides) in an austenitic matrix. Heating for 1 hr. at 1800 to 2400° F. produced some ferrite, the amount increasing with temperature. During solution treatment at 2350° F. for 2 to 256 min., the amount of ferrite increased progressively for the first 128 min. and then decreased slightly. Aging specimens with 20 and 2% ferrite at 1200 to 1600° F. for 0.1 to 100 hr. revealed that in the former, sigma first appears after 1 hr. at 1600° F. and in the latter, after 100 hr. at 1400 and 1600° F. The presence of ferrite promotes sigma formation, but the effect of cold work is more pronounced.

Oxidation

Rapid oxidation of Timken 16-25-6 and similar alloys has been found to occur at high temperatures when specific conditions exist; these conditions are an oxidizing atmosphere and severely restricted circulation (6c-37, Nov. 1948). The alloys susceptible to this type of attack contain over 3% molybdenum and considerable iron.

Oxidation of this type is so severe that the term "catastrophic oxidation" has been applied. This oxidation is general, rather than intergranular, and the reaction takes place at the metal-oxide interface. Since the oxide is porous, continuing penetration of the oxygen inward occurs readily.

The phenomenon is caused by the action of MoO_3 as an oxidation catalyst. Thermal dissociation of MoO_3 accelerates the oxidation and this dissociation may be the chief cause of the extremely rapid destruction of the alloys. The only factors which substantially affect the rates of oxidation are temperature and the concentration of molybdenum oxide or other volatile oxide vapors on the surface. Other metal oxides which melt at relatively low temperatures and greatly increase the oxidation rates of iron, nickel, chromium, cobalt, and their alloys are V_2O_5, PbO, Bi_2O_3 and WO_3.

The rapid destruction of molybdenum-bearing high-temperature alloys in oxidizing atmospheres can be prevented by an appreciable movement of gas across all surfaces of the metal. Close proximity of the surfaces will inhibit air circulation and increase the concentration of molybdenum oxides. This type of oxidation may be reduced by reducing the carbon content of the alloy to a minimum, reducing the nitrogen and molybdenum, and increasing the chromium content.

Ceramals

"Ceramals" or "cermets" are materials produced by combining a ceramic, such as an oxide, carbide, nitride, boride, silicate, or silicide, with a metal or alloy (5a-51, Oct. 1948; 5a-62, Dec. 1948). The combination is effected at high temperatures under controlled atmospheres using methods similar to powder metallurgy techniques; the product has properties that differ from those of the components. Ceramals have good high-temperature strength together with resistance to oxidation and intergranular corrosion. The strength of ceramals at high temperatures is greater than that of the metal constituent and approaches that of the ceramic components.

Bobrowsky investigated ceramals of titanium carbide with 5 to 30% additions of cobalt, molybdenum, or tungsten, for use as blade materials (described in a 1948 preprint for the American Society of Mechanical Engineers). Of the cobalt-bearing mixtures, those with 20 and 10% additions showed the highest tensile strengths at 1800 and 2200° F., respectively (33,200 and 14,300 psi., respectively); these were as good as, or better than, the best alloy used for comparison.

At 1600 and 2000° F., 20% cobalt appeared to be the best binder addition, resulting in moduli of rupture of approximately 100,000 and 55,000 psi., respectively, but the optimum additions of molybdenum or tungsten as binders varied at these temperatures. At the highest evaluation temperature, 2400° F., the molybdenum-bearing ceramal was the strongest, that with tungsten intermediate, and that with cobalt the weakest.

Oxidation rates of carbide ceramals are not excessive at moderate temperatures. However, at gas temperatures of 2100 to 2200° F. they are so high that the life of a turbine blade would probably be limited to about 10 hr. The oxides formed on the 20% cobalt ceramal were TiO_2 and $CoTiO_3$. When the layers formed

Type Composition of Alloys

ALLOY	C	CR	NI	CO	MO	W	CB	TI	FE	OTHERS
19-9 W-Mo	0.1%	19%	9%		0.4%	1.3%	0.4%		68%	
19-9 D1	0.3	19	9		1.2	1.2	0.4	0.3%	67	
16-25-6	0.15	16	25		6				51	N 0.18%
CSA	0.3	18	5		1.3	1.2	0.3		Bal.	Mn 4.5
EME	0.12	19	12			3.4	1.3		Bal.	
N-155	0.3	20	20	20%	3	2	1		32	
S-590	0.4	20	20	20	4	4	4		25	
S-816	0.4	20	20	44	4	4	4		3	
Refractaloy 70	0.11	20	20	30	8	4			15	
Refractaloy 26	0.05	18	37	20	3			2.8	18	Al 0.2
Inconel	0.05	14	78						7	Cu 0.2
Inconel W	0.05	14	75					2.5	6	Cu 0.1, Al 0.6
Inconel "X"	0.05	15	73				1	2.5	7	Cu 0.2, Al 0.6
Hastelloy B	0.12		64		29				5	
Hastelloy C	0.15	15	56		18	4.5			5	
Vitallium (HS-21)	0.25	27	2.5	Bal.	5.5				2 max.	
6059 (HS-27)	0.40	26	Bal.	30 min.	6				2 max.	
61 (HS-23)	0.40	26	1.5	Bal.		5			2 max.	
422-19 (HS-30)	0.40	26	15	Bal.	6				2 max.	
X-40 (HS-31)	0.52	26	10	Bal.		7.5			2 max.	
J	0.76	23	6	Bal.	6					Ta 2
Nickel base	0.1	15	Bal.		5.5		2		4.5	Al 6, B 0.5
R.22	0.3	25	14.5			3.2			Bal.	Si 1.3
G.18B	0.4	13	13	10	2	2.5	3		Bal.	Si 1
Nimonic 80	0.1 max.	20	Bal.					2	5 max.	Al 1

National Officers Nominated for 1949-50

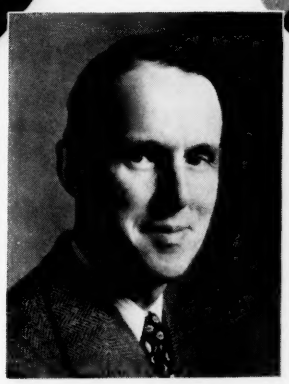
Arthur E. Focke, research metallurgist for Diamond Chain Co., Indianapolis, has been nominated for president of the American Society for Metals, to serve for one year starting next fall. At the same time, Walter E. Jominy, staff engineer of Chrysler Corp. Detroit, has been nominated for a one-year term as vice-president, and Ralph L. Wilson, chief metallurgical engineer for Timken Steel and Tube Division, for a two-year term as treasurer.

Two new nominees to the board of trustees, to serve for two years each, are Elmer Gammeter, chief metallurgist for Globe Steel Tubes Co., Milwaukee, and Thomas G. Digges, metallurgist at the National Bureau of Standards, Washington, D. C.

Dr. Focke, who has been national vice-president of the society for the past year, is a graduate of Ohio State University, where he also received his M. S. and Ph. D. degrees. He has been with Diamond Chain since 1930, following employment as special metallurgist for General Electric Co. and as chief engineer for P. R. Mallory Co. He is a past chairman of the Indianapolis Chapter A.S.M.

W. E. Jominy
For Vice-President

R. L. Wilson
For Treasurer



A. E. Focke
For President

T. G. Digges
For Trustee

E. Gammeter
For Trustee

Walter Jominy, whose name is closely associated in metallurgical minds with the end-quench test for hardenability, took his master's degree at University of Michigan. He later did important work on scaling of steel in the University's department of engineering research (1923-31) and also as research metallurgist for A. O. Smith Corp. From 1934 until he joined the Chrysler Corp. in 1941, he was metallurgist in the research laboratories division of General Motors Corp.

Mr. Jominy was the recipient in 1944 of the Albert Sauveur Achievement Award presented by the American Society for Metals, and also was cited for a Distinguished Service Award at the National Metal Congress last fall, for meritorious contributions to progress in alloy steels.

Ralph L. Wilson, the nominee for treasurer, is a 1921 graduate of Lehigh University. His experience includes six years with the metallurgical departments of the United Alloy Steel Corp. and Central Alloy Steel Corp., after which he was for ten years metallurgical engineer for Timken Steel and Tube Division.

In 1937 he joined the staff of Climax Molybdenum Co., and then served during the war as chief of the constructional steels section of the metallurgical and conservation branch, War Production Board. He rejoined Timken as chief metallurgist in 1944. Mr. Wilson served on the A.S.M. board of trustees in 1938-39.

Elmer Gammeter, nominated as trustee, has been with Globe Steel Tubes since 1943. Prior to that he was manager of the stainless steel bureau, metallurgical division, Carnegie-Illinois Steel Corp. in Chicago, following six years as metallurgist for Edison General Electric Appliance Co. His education was received at Missouri School of Mines and Metallurgy (B.S., M.S. and Metallurgical Engineer degrees). He was chairman of the Chicago Chapter A.S.M. in 1937-38.

T. G. Digges has served with the division of metallurgy of the National Bureau of Standards since 1920, and is at present chief of the thermal metallurgy section. He attended Virginia Polytechnic Institute and George Washington University, getting his B.S. in physics from the latter institution.

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on 20% cobalt-ceramal blades were as thick as 1/16 in., the oxides were still capable of withstanding operation at high temperatures and rotative speeds.

Carbide ceramals have high thermal conductivity, and would present wheel-cooling difficulties when used as blades because of the high heat transfer from the combustion gases to the wheel rim. These difficulties could probably be circumvented by using better wheel alloys or by additional wheel cooling.

Ceramal blades were operated in test gas turbines at temperatures above those to which alloy blades are subjected in service, although the speeds were lower. Life of ceramal blades is short, primarily because of mechanical design problems. Research on high-temperature fatigue resistance is required before ceramals can be considered competitive with heat resisting alloys for any but short-time service.

The fabrication and properties of hot-pressed chromium boride ceramals were discussed by Sindeband (4C-24, March 1949). For a particular particle size there is an optimum pressing temperature, which decreases with particle size. With the optimum combination of 3 to 5 microns particle size, approximately 2800° F. pressing temperature, and 15% nickel binder, the room-temperature modulus of rupture was about 120,000 psi. Using the same amount of nickel-copper (70-30), nickel-chromium (60-40), or cobalt as binder, the ceramals, with one exception, yielded similar modulus values; the cobalt ceramal showed only 80,000 psi. At 1500 to 1600° F., the rupture strength of the chromium boride with 15% nickel was only one-quarter that of cast Vitallium. Air corrosion tests at 1525 to 2050° F. revealed the formation of a liquid phase at 1900° F., probably resulting from liquation of the nickel borides formed; this limits the use of this material to a maximum temperature of 1750° F.

Utah Chapter Formally Installed

Left to Right at Utah Chapter's Installation Meeting Are A. Ray Olpin, President, University of Utah; Arthur E. Focke, A. S. M. Vice-President and Principal Speaker; Chairman W. C. Dyer, Holding the Charter; Don Rosenblatt, Vice-Chairman; and H. Ed Flanders, Secretary-Treasurer

The Utah Chapter of the American Society for Metals was formally installed with charter by Arthur E. Focke, vice-president of the national society, at a dinner meeting in Salt Lake City, on April 19. Following the charter presentation by Dr. Focke and its acceptance by W. C. Dyer, chairman of the Utah Chapter, Dr. Focke gave the main address of the evening on "The Metallurgist, the A.S.M. and the Metals Industry." The talk was followed by a lively question and answer session presided over by Chairman Dyer.

Among the guests were A. Ray Olpin, president, University of Utah, and Franklin S. Harris, president, Utah State Agriculture College. The Utah Chapter was organized last September 28, at a meeting in Salt Lake City and has had several meetings during the course of the season.

Lippert Talks at Birmingham

Reported by H. A. Lilly

Sales Engineer
Aluminum Co. of America

Sustaining Members' Day of the Birmingham Chapter A.S.M. was held on April 5. Events were started with a luncheon honoring T. W. Lippert, directing editor of *Iron Age,* and guest speaker for the evening meeting.

Mr. Lippert's subject was "The Future of the Metals Industry", and his talk was along economic rather than technical lines. The coffee talk at the evening meeting was given by A. V. Wiebel, vice-president, Tennessee Coal, Iron & Railroad Co. Engraved certificates were also presented to the sustaining members.

Silverware Operations Inspected in Plant Tour By Syracuse Members

Reported by Harry A. Johnson

Gear Engineer, Aircooled Motors, Inc.

The April meeting of the Syracuse Chapter A.S.M. was crowded with events sponsored by Oneida Ltd. Conducted tours through the silverware plants in the afternoon were followed by an excellent dinner, a brief talk by M. E. Robertson, a sleight-of-hand performance by a local artist, two reels of industrial movies, and finally a general social period with additional refreshments.

The 2-hr. tour through the plants was arranged to give a broad idea of the various processes involved in the manufacture of silverware, such as punching, rolling, stamping, brazing, plating, polishing and inspection.

Mr. Robertson, who has been general manager of Oneida Ltd. for the past 23 years, told how the present business was started by a religious group in 1848. The factory was under community control and ownership, and though it was later converted to a stock company, it is still swayed to a large extent by the old community idea in its dealings with employees.

One of the movies described and illustrated the forging, extrusion, fabrication and many of the uses of aluminum, and stressed the variety of complicated sections economically produced by the extrusion process. The other movie illustrated the various steps involved in the production of magnesium.

Service Tests Are Ultimate Proof of Adequate Design

Reported by Knox A. Powell

Research Engineer, Minneapolis-Moline Co.

The aim of the engineer, according to H. B. Knowlton, supervisor of materials engineering for the International Harvester Co., is to design adequately for the required service, and nothing more if it costs extra money. Mr. Knowlton addressed the North West Chapter A.S.M. on April 21 on "Properties and Service Performance of Carbon and Alloy Steels".

Service tests are the ultimate proof of adequate design, he said. A bumblebee actually takes wing even if aeronautical engineers figure that it can't fly. The trouble with a service test, however, is that it generally takes so long that the answer comes too late to be useful. Tentative laboratory fatigue tests have been developed which will correlate with field performance.

Mr. Knowlton showed projected charts of fatigue tests of steel, which indicated that erroneous conclusions may easily be drawn from the results of overstress tests. Fatigue tests should be conducted to determine maximum stress for any desired length of life, rather than to determine comparative life under overstress conditions.

While plasticity is often needed to equalize unevenly distributed stresses, only a certain amount of plasticity is necessary for any given application. Greater plasticity may not add any additional merit. For example, a steel with 60% elongation is no better than one with 20% elongation, for applications which cannot conceivably produce more than 2 or 3% elongation in service.

Mentioning the factors that lead to success and failure of typical automotive parts, Mr. Knowlton stressed the value of involute splines, and of large fillets at the roots of gear teeth and splines. Residual stresses at the surface of heat treated parts are highly important.

By studying the actual performance of finished parts, it is possible to determine just what properties are needed for successful performance. In changing from one type of steel or treatment to another, it is not always necessary to duplicate all of the properties of the former—the aeroplane does not have to flap its wings in order to fly! Similarly an induction hardened part does not necessarily need the same hardening pattern as the case hardened specimen, providing the properties of the material and the distribution of internal stresses are adequate for the particular application.

Economy in Production Will Be Central Theme of October Metal Congress

"Economy in Production" will be the central theme of the 31st National Metal Congress and Exposition when the annual event takes place in Cleveland's Public Auditorium, Oct. 17 through 21, 1949.

This will be the first postwar program to concentrate national attention on the greater efficiency of modern industrial equipment. Actual demonstrations will show what the equipment will do to effect savings and thus reduce the unit cost of the product or part it helps to make. The "know-how" of cost-cutting principles will be discussed during the special technical and educational sessions of the Metal Congress; the "show-how" of production economy will be graphically demonstrated by the exhibitors. With materials, equipment and processes they will illustrate the proper application and most efficient operation of their product as a contribution to savings in production.

"The metal industry is going all-out to effect savings in processing and fabrication," said W. H. Eisenman, managing director of the October Metal Show. "Within the industry," he continued, "lies the basic first step toward reducing unit costs of all products made of metal. Hundreds of prominent exhibitors who will be in the October Metal Show have the equipment and the skill to bring about substantial savings in production costs. Their purpose in being a part of the Metal Exposition is to show why their equipment or process reduces costs, and to show how this is done."

The National Metal Congress in Cleveland will emphasize methods of reducing production costs by efficient use of equipment and processes. For the benefit of an estimated attendance of over 50,000 management officials, metal engineers, production specialists and sales executives, the theme "Economy in Production" will demonstrate the "know-how" of metal applications and the "show-how" of metal treatment and fabrication.

Cooperating in the National Metal Congress will be the American Society for Metals; the American Welding Society; Metals Divisions, American Institute of Mining and Metallurgical Engineers; and the Society for Non-Destructive Testing.

St. Louis Meets at Alton

Reported by H. O. Nordquist

Manager, Alloy & Stainless Steel Dept. Joseph T. Ryerson & Son, Inc.

On April 21 the St. Louis Chapter A.S.M. met with the Alton, Ill. contingent at the Mineral Springs Hotel at Alton. This meeting is an annual affair every Spring, and is under the direction of the A.S.M. members at Alton.

George A. Roberts, chief metallurgist of the Vanadium-Alloys Steel Co., gave a highly interesting talk on "New Developments in Toolsteel". The lecture has been reported in earlier issues.

New Stainless Wire Mill

A new stainless steel wire mill will be opened officially on June 23 by American Steel & Wire Co. at its Waukegan, Ill., works. The new mill employs specially designed machinery and will have a capacity of 500 tons a month.

The Reviewing Stand

A POPULAR FEATURE of several of the National Metal Congresses held during the war years was a series of round table discussion meetings designed to help solve pressing war production problems in the metal field. The idea will be adapted to peacetime conditions next fall when the annual National Metal Congress will be built around the theme of "Economy in Production" (see story just above).

The round table discussions for this "Cost-Cutting Congress" will be conducted by a panel of experts and patterned after the University of Chicago's well-known radio program. Each panel will discuss some metallurgical or manufacturing operation, presenting ideas about new processes, new equipment, new methods, new relationships, that would perfect the metallurgical or manufacturing operation or make it more economical or more efficient.

Various topics have been suggested where cost-cutting possibilities can be developed. Typical examples are: use of appropriate heat treatment; selection of the most suitable welding method, decision as to whether the part should be cast, forged or welded; selection of appropriate casting method (centrifugal, pressure or gravity, precision molding, die casting, permanent molds, special molding and core materials); inspection procedures (too little or too much inspection); and use of most economical and efficient fabrication methods.

Other suggestions will be welcomed in planning this program, and readers are invited to contribute ideas. If you have a problem where you feel that more efficient use of labor, material or power might be made, just outline it briefly in a note addressed to the National Metal Congress, 7301 Euclid Ave., Cleveland 3, Ohio. Such suggestions will be of great help in planning these meetings.

A LETTER to the editor calls attention to an unfortunate distortion of fact implied in the April issue of *Metals Review*. This occurs in Question 10 in the quiz on page 4, which read: "What college recently established an award to recognize achievement in metallurgy by an alumnus?"

This should have read: "What A.S.M. chapter recently established an award to recognize achievement in metallurgy?", and the Penn State Chapter chairman and chairman of the awards committee have jointly cleared up the confusion as follows:*

"The Penn State Chapter of the A.S.M. enjoys the privileges of maintaining its headquarters in the School of Mineral Industries of the Pennsylvania State College and of holding its technical sessions on the campus of that university. . . . relations between the chapter and the School of Mineral Industries could hardly be more intimate or more cordial.

"Nevertheless, the David Ford McFarland Award for Achievement in Metallurgy was established by the Penn State Chapter of the A.S.M., acting independently and even without the official knowledge of any college authority. The distribution of the award is likewise entirely in the chapter's hands.

"The chapter has no wish to place the college or the school, which maintain an impartial regard for all alumni, in the position of seeming to show favoritism. Those staff members of the college who have taken part in this enterprise have done so as individual members of the A.S.M. and not as officers of the Pennsylvania State College."

J. H. KEELER
Chairman, Penn State Chapter
H. M. DAVIS
Chairman, Awards Committee

* For a story on the first presentation of the award by the Penn State Chapter, see page 17.

Metals Review's Honor Roll of the Well Informed

The following readers returned correct answers to the quiz page in the April issue of Metals Review. To earn a place on this honor roll, turn to page 4 and test your own knowledge of current events in the metal industry.

Edward Lawrence Badwick, metallurgist, Hyatt Bearings Division, General Motors Corp.; John H. Bassarear, student, Colorado School of Mines; Alvin E. Beetham, dispatcher, Western Gear Works; C. H. Betts, captain, Canadian Army; Dale Bittinger, assistant superintendent, sheet mill, Jessop Steel Co.; Earl J. Bleakley, assistant metallurgist, Jeffrey Mfg. Co.; G. W. Boyd, associate professor, Michigan College of Mining and Technology; W. W. Brenneman, Lima Hamilton Corp.; William Bruce, toolmaker, McCord Corp.; Adam W. Baer, Cleveland.

H. A. Caldwell, Tennessee Coal Iron and Railroad Co.; Hallock C. Campbell, associate director of research and engineering, Arcos Corp.; Charles Canitz, Jr., metallurgist, Glenn L. Martin Co.; Ralph R. Casper, heat treater, Eastman Kodak Co.; E. J. Casselman, research engineer, Eversharp Inc.; Keith Charters, salesman, Harrington Tool and Die Co.; R. Ernest Christin, chief metallurgist, Columbus Bolt & Forging Co.; Joseph W. Conway, metallurgist, Crucible Steel Co. of America.

Gerard Davidse, metallurgist, Allegheny-Ludlum Steel Corp.; H. A. DeVincentis, project leader, Sylvania Electric Products; Gerrit De Vries, metallurgist, U. S. Naval Proving Ground; Claude C. Dierdorf, metallurgist, Keller Tool Co.; Ervin A. Domzal, metallurgical department, Hoover Ball & Bearing Co.

David Edelstein, metal buyer, Federated Metals Division, American Smelting & Refining Co.

George L. Flint, assistant department head, metallurgical laboratory, Carbide and Carbon Chemical Co.; James L. Foster, metallurgist, Wheel & Brake Division, Goodyear Aircraft Corp.

John E. Gaus, metallurgist, General Electric Co., Leonard C. Grimshaw, metallurgical engineer, Jessop Steel Co.

E. A. Hall, heat treat foreman, Schwitzer-Cummins Co.; Frederick W. Hanson, eastern service manager, Electro Metallurgical Division, Union Carbide & Carbon Corp.; Alfred C. Harris, metallurgist, Kraeuter & Co., Inc.; Harold T. Harrison, research metallurgist, National Cash Register Co.; D. C. Heckard, metallurgical assistant, Armco Steel Research Laboratory; Louis W. Hille, instructor, machine shop, Philadelphia School District; C. C. Hoffman, metallurgist, Timken Roller Bearing Co.; P. S. Hoffman, metallurgist, Treadwell Engineering Co.; Frank H. Holmes, Lieutenant Colonel, U.S.A.F., Munitions Board; E. W. Husemann, metallurgist, Copperweld Steel Co.

H. Richard Irwin, metallurgical engineer, Babcock & Wilcox Tube Co.

C. H. L. Jones, chemist.

David L. Kistler, methods engineer, Carpenter Steel Co.; Anthony Klinshaw, hammerman, Worthington Pump and Machinery Corp.; Raymond B. Koehler, materials engineer, Army Ordnance; P. A. Koerner, metallurgist, Beech Aircraft Corp.; Alfred S. Kos, chief engineer, Globe Stamping Division of Hupp Corp.; Arthur Kugelman, metallographist, Portsmouth Steel Corp.

E. F. Lackman, metallurgical engineer, Republic Steel Corp.; Bert R. Lanker, chief metallurgist, Farrell-Cheek Steel Co.; Mike Lauriente, service engineer, Pittsburgh Lectromelt Furnace Corp.; John C. Lehmann, heat treat tool expert and tool straightener, Kaiser Frazer Corp.; W. H. Leitton, manager, electrical products division, United States Time Corp.; John J. Linnehan, service engineer, Linde Air Products Co.; Edward G. Littell, metallurgist, Redmond Co., Inc.; Robert St. Clair Low, powder metallurgist.

John M. Marchi, metallurgist, Permanente Metals Corp.; James H. Marshall, metallurgist, Seeger Refrigerator Co.; John J. McClanahan, metallurgical engineer, Alabama Pipe; George A. Meyer, Jr., shop practice engineer, Malleable Founders' Society; Donald K. Miller, heat treat foreman, Weirton Steel Co.; David M. Moses, process engineer, Carnegie-Illinois Steel Corp.; Carl H. Mull, toolmaker, Gleason Works.

E. L. Novomesky, metallurgist, Wright Aeronautical Corp.

Rinaldo A. Paci, metallurgical technician, E. F. Houghton & Co.; Monte E. Parker, shop superintendent, U. S. Navy; Alfred Pasler, heat treater, Alfred Hofmann & Co.; David W. Pettigrew, Jr., research engineer, Aluminum Research Laboratories; Leslie B. Piper, rolling mill metallurgist, Carnegie-Illinois Steel Corp.

Robert H. Raymond, sales engineer, Eagle Metals Co.; A. H. Roberson, metallurgist, U. S. Bureau of Mines; John Roberts, works metallurgist, Darlington Forge Ltd., England; Nicholas E. Rothenthaller, manager, quality control (steel), Ford Motor Co.

S. L. Scheier, superintendent, Columbus Bolt & Forging Co.; Richard D. Schoch, sales engineer, Ladish Co.; Robert I. Schub, technical director, Division Lead Co.; Fred E. Seuffert, metallurgical chemist, Lyon, Inc.; Edwin G. Shifrin, assistant welding engineer, Detroit Edison Co.; Arthur M. Shrager, teacher, Brooklyn Technical High School; Gordon H. Silver, metallurgist, Monarch Machine Tool Co.; A. P. Simpson, owner, Simpson Motor; Charles L. Smith, metallurgist, Miller Co.; G. S. Storer, mechanical inspection supervisor, Carbide and Carbon Chemical Corp.

E. S. Taylor, sales engineer, Pacific Steel Casting Co.; R. C. A. Thurston, metallurgical engineer, Bureau of Mines.

Greswold Van Dyke, metallurgist, H. & B. American Machine Co.

William Wilson, Jr., research engineer, Armour Research Foundation; Henry H. Wulf, heat treater, Naval Air Station.

Peter E. Young, research chemical engineer, Briggs Manufacturing Co.

Turn to page 4 for this month's quiz

Alcoa Plays Host to Pittsburgh Chapter

Francis C. Frary (Right), Director of Research for Aluminum Co. of America, Was the Principal Speaker When the Pittsburgh Chapter Visited the Alcoa Plant in New Kensington. Others in the photograph (from left) are J. L. Patterson, manager of the New Kensington Works; Tim Merrill, chapter chairman; and H. V. Churchill, master of ceremonies

Reported by C. T. Haller
International Nickel Co.

A visit to the New Kensington plant of the Aluminum Co. of America featured the annual regional meeting of the Pittsburgh Chapter on April 29. This yearly visit to one of the plants in the Pittsburgh district was well attended, and the company provided excellent guides and facilities to produce a tour that was both interesting and educational.

The evening meeting, following a dinner at the Brackenridge Country Club, was addressed by Francis C. Frary, director of research for Alcoa, who presented a picture of the light metals industry.

Production of primary aluminum in the United States rose from about 145,000 tons annually during 1938-1939 to over 900,000 tons during the war years. Magnesium showed even a greater percentage increase, due to its extensive use in incendiary bombs during the war.

The present shipments of aluminum amount to over 1,000,000 tons annually, about 80% of which is in wrought products. Shipments of magnesium during 1948 amounted to about 8,000 tons, of which only about 30% was in wrought products. A fundamental difference in the application of these two materials is apparent in these figures.

Dr. Frary pointed out that a number of the large plants constructed by the Government during the war were built in locations where the cost of power would prove uneconomical for commercial operations. For example, the largest aluminum plant in the country was located on Long Island, with power made available by the brown-out operating in New York City.

Moves Sales Department

The McKay Co. has moved its electrode sales department from York, Pa., to the company executive offices in the McKay Bldg., Pittsburgh. Fred A. Kaufman is manager of electrode sales.

Sauveur Lecturer Relates Martensite Transformation to Nucleation Theory

Reported by Howard J. Godfrey
John A. Roebling's Sons Co.

The Sixteenth Annual Sauveur Lecture presented before the Philadelphia Chapter A.S.M. last March will rank among the most thought-stimulating addresses ever to be delivered before that group. John Herbert Hollomon, research associate of the General Electric Co., was the speaker, and his subject "Nucleation".

It is necessary to have a decrease in free energy in order to have a phase transformation continue, Dr. Hollomon pointed out in discussing the basic theory of nucleation in relation to phase transformations. He illustrated this energy relationship by citing the transformation of water vapor to water at various temperatures.

Dr. Hollomon startled his attentive audience by announcing that there is always some water in water vapor and there is always some ice in water. He illustrated the size-energy relationship for the transformation of water to ice *above* the equilibrium temperature and showed that all energy terms are positive. Therefore the number of unstable ice embryos decreases rapidly with increasing size and thus no nuclei ever form. For transformation *below* equilibrium temperature, however, the bulk free energy is negative. There will therefore be a decrease in energy when the particle size has grown beyond a point where the surface energy no longer restricts the transformation.

Clouds of water drops do not freeze until a temperature of −38° C. is reached. The supercooling arises from the necessity for forming the surface between ice and water. Similar experimental results were illustrated for mercury, tin and gallium. Graphs showed that the rate of nucleation is also dependent upon the temperature.

Dr. Hollomon then focused his discussion on the formation of martensite. Fundamentally, the martensite transformation is a process of nucleation and growth and its kinetics can be calculated. For example, the calculated and measured Ms temperatures were shown to be in agreement.

These ideas were also confirmed by data of Kurdjumov and Maksimova (Russia) which show that the martensite reaction is a growth process instead of a shear process. The rate of the martensite transformation is high and the quantity of martensite is a function of temperature and nearly independent of time.

The Russian data clearly showed that by quenching austenite to very low temperatures, its rate of transformation and dependence on temperature could be measured. A 0.6%C,

John H. Hollomon Research Associate for G. E., Delivering the Sauveur Lecture for the Philadelphia Chapter

6.0% Mn steel quenched in liquid nitrogen was entirely austenitic. After raising the temperature to −159° C. the martensitic transformation began immediately. The transformation continued at this temperature and after 3 hr. 12% of the austenite was transformed. Other similar examples of martensitic transformation were illustrated on slides.

At the conclusion of the lecture the members participated in a discussion of this new representation of the martensitic transformation as a thermal process of nucleation and growth.

Prior to the Sauveur Lecture, past chapter chairmen were introduced, a coffee talk was presented on "Antidote for Communism", and Past President Francis B. Foley presented a series of slides and described the dedication of the Sauveur Memorial Room at the national headquarters in Cleveland.

Engineering School Toured

Reported by G. F. Kappelt
Metallurgist, Bell Aircraft Corp.

A tour of the University of Buffalo's school of engineering highlighted the April meeting of the Buffalo Chapter A.S.M. Prior to the actual tour, Dean Mohn prepared the members for the visit by giving them a thumbnail sketch of the growth of the university and the relatively strong position of the school of engineering.

The engineering division now is on a par with the other divisions in enrollment and physical size. The actual three-story engineering building has, besides classrooms, laboratories to take care of mechanical, electrical and civil engineering.

THIRTY YEARS AGO

After a short life as independent organizations, the Steel Treating Research Society and the American Steel Treaters Society merged in 1920 to form the present American Society for Metals. The early issues of the official publications of these two societies (1917-1920) are filled with nostalgic and historical associations.—Ed.

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An important article in a wartime issue of the *Proceedings* is entitled "The Metallurgist and the Aircraft Program" (author: LIEUT. H. F. WOOD, U. S. Army Signal Corps; currently vice-president of Wyman-Gordon Co., Harvey, Ill.). In those pre-radiographic days, Lieut. Wood found that "one of the greatest difficulties with aluminum castings is to select a test that really will tell you the difference between a good casting and a bad casting. . . . A tensile bar does not tell you just what you would like to know. . . . It is necessary to rely on chemical analysis almost entirely to test die and permanent mold castings."

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A new process known as "calorizing" was coming in for a lot of attention in those days, and was described in a lecture on "The Protection of Metals From Oxidation at High Temperatures" presented before the Chicago Chapter. The speaker was W. E. RUDER of General Electric Research Laboratories (now G. E.'s head of the metallurgy division). S. J. HERMAN of the Calorizing Corp. of America answered detailed questions regarding size and shape of material that could be handled.

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Among associate editors added to the staff of the *Journal* in December 1918 was D. K. BULLENS, consulting metallurgist and author of the time-honored textbook "The Heat Treatment of Steel".

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The first new chapter of the American Steel Treaters' Society was organized in Cleveland on Jan. 24, 1919, with W. S. BIDLE (later to serve as a national president) as chairman.

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At the first meeting of the new Cleveland Chapter, National Secretary W. H. EISENMAN not only gave his now-classic remarks on the objects and benefits of the national society, but also presented the main address on "Heat Treatment; Its Past, Present and Future." This famous talk was later presented before a long succession of new chapters.

Unique Materials Developed in Bell Telephone Labs

Reported by F. R. Anderson
Chief Metallurgist
Gardner-Denver Co.

Drawing a parallel between Toynbee's Outline of History and progress in engineering, J. R. Townsend, materials engineer for Bell Telephone Laboratories, Inc., philosophized on the factors which favor and determine scientific advancement, in an address before the Rocky Mountain Chapter A.S.M. He designated five periods of engineering growth as: 1800 to 1840—Transportation; 1840 to 1880—Mechanical Engineering; 1880 to 1920—Electrical and Automotive Engineering; 1920 to 1940—Chemical Engineering; since 1940 Nuclear or Electronic Engineering.

The tempo of advance has doubled in the past 30 years and is largely due to the efforts of individual thinkers. Their best results stem from reasoned analyses made in "cloistered" surroundings away from the scene of action, the speaker said.

Bell Telephone Laboratories have large research facilities which permit extreme specialization in the many fields pertaining to their work. Practically all of their investigation, however, has a close relationship to immediate problems.

One of the most important new materials, according to Mr. Townsend, is the family of war-born plastics. Even metallurgists have resorted to their use! Applications include wire insulation to replace the time-honored lead sheath for cable, "sandwich" buildup for relays, and adhesives for metal-to-plastic bonds.

Remarkable magnetic materials are made up of sintered metal oxide compacts yielding a cubic ferromagnetic structure especially suitable for frequencies up to 10 million cycles. Their manufacture requires special pressing equipment incorporating chromium plated dies and vibrators to assist compacting.

Vapor-phase deposition of extremely thin layers of metal is used in the manufacture of tiny condensers. Zinc condensed on paper has the peculiar property of resisting breakdown because the surface tension of the thin layer pulls it away from the perforation, giving the condenser a "self-healing" ability.

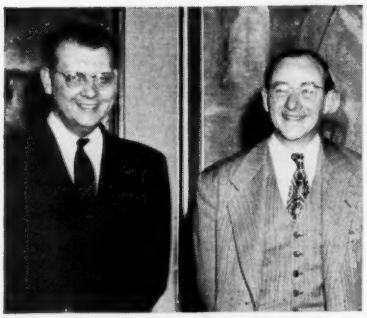
Other materials are the Thermistor, whose resistance decreases with heating (used in thermometers and temperature control devices); the Varistor, which limits current or voltage flow; the Transistor, and others of similar nature.

Single crystals of germanium possess the ability to control electron flow in a manner similar to that of a vacuum tube without the need for a "heater", an attribute utilized to make miniature radio devices. This metal passes a broad band of frequency, making its possible application very extensive. The discovery of this amazing property was made less than one year ago.

Of the "substitute materials", the most notable is the plastic-aluminum sheath for telephone cable, with more than 3000 miles in present use. Metal is necessary to prevent infiltration of moisture, while plastic provides mechanical strength. The thickness of aluminum used is only 0.008 in.

As a final admonition, Dr. Townsend advised engineers to watch the discoveries of the physicist and chemist and apply them to practice.

Magnesium Alloy Properties Predicted



In Penn State's Mineral Industries Art Gallery Following the March Meeting Are: (Left) R. W. Lindsay, Associate Professor of Metallurgy; and (Right) R. S. Busk of Dow Chemical Co., the Principal Speaker (Photo by S. P. Jones)

Reported by F. R. Lorenz, Jr.
Pennsylvania State College

The fundamental aspects of alloy behavior have been studied to determine the effects of alloying elements on the properties of magnesium, according to R. S. Busk, director, laboratory development division, Dow Chemical Co., addressing the Penn State Chapter A.S.M. on March 8.

After a brief discussion of the actual effects of alloying elements with respect to microstructure and physical properties, Dr. Busk showed how attempts have been made to correlate fundamental atomic constants and the geometry of the magnesium lattice with mechanical behavior, so that alloy properties might be predicted. The workability qualities of alloys vary with respect to the c/a ratio as it is modified by additions to change the electron concentration.

A large amount of slide data was used to illustrate and strengthen the ideas presented. Dr. Busk concluded by pointing out several interesting departure points for future research along these lines.

Plastics Products Upgraded By Cooperative Effort

Reported by John R. Dobie
Mechanical Engineer
Wickwire Spencer Steel Co.

Members of the Worcester Chapter were given some of the inside story on plastics at the March 9th meeting when E. E. Ziegler, of Dow Chemical Co. spoke on "Selection of Plastics for Engineering Applications".

Mr. Ziegler reviewed some of the recent history of the "plastics era" and pointed out that the phenomenal growth of the industry has been slowed up in many instances by faulty selection of materials, poor design, and poor workmanship.

The speaker, as head of the testing section of plastics technical service, was well equipped to elaborate on the extensive product evaluation program which the Dow Chemical Co. has undertaken to upgrade the quality of plastic products offered on the market. By combining the efforts of the raw material supplier, the molder, and the distributor into one cooperative effort, it has been possible in the brief 18 months' history of this program to observe the slow but positive improvement in over-all quality.

Heat Treating Hints Shown And Equipment Described

Reported by D. W. Grobecker
Metallurgical Engineer

A talk on furnace and induction heating equipment by L. A. Shea, engineer of the Lindberg Engineering Co., at the April meeting of the Los Alamos Chapter A.S.M. was augmented by a showing of the sound motion picture "Heat Treating Hints" and slides of typical furnace applications.

Mr. Shea discussed German furnace techniques in use during the last war. German heat treating methods in the main were laborious and not adaptable to production systems. Of interest was the German development of a two-compartment, low-frequency induction furnace for aluminum melting. A furnace of this type has undergone development and further improvement by Lindberg for marketing in this country.

The film on Heat Treating Hints contains worthwhile suggestions for the practical heat treater. Methods of protecting surface finish in a non-atmosphere furnace by means of boric acid baths and carbonaceous compound are shown. The film also illustrates techniques for hardening, straightening, and shrinking.

Explains Microstructure in Terms of Topology

Reported by Morris Cohen
Massachusetts Institute of Technology

The 1949 Sauveur Memorial Award of the Boston Chapter was presented to Cyril Stanley Smith of the Institute for the Study of Metals at the University of Chicago at the conclusion of his stimulating and scholarly lecture on "Microstructure of Metals" commemorating Boston's annual Sauveur Night.

Dr. Smith introduced his subject by pointing out that the microstructure of an alloy results from the division of space in accordance with topological necessity, limited by the requirements that the interfaces between various grains tend to establish equilibrium positions at angles depending on their relative energies. The boundaries in a polycrystalline aggregate of a single-phase metal or alloy have an arrangement closely similar to that of a froth of soap bubbles, with each boundary meeting two others at an angle of 120°. Grain growth tends to occur in such an alloy whenever the geometry departs from a net of hexagons (two-dimensional) or minimum-area tetrakaidecahedra (three-dimensional) for these are the only shapes where the topological requirements can be reconciled with angles of 120° without introducing curvatures. Grain growth may stop either because of the influence of a second phase, or because slight variations of energy with orientation render a curved boundary or a five-grain junction stable. Localized removal of such a block may produce exaggerated grain growth.

The speaker then considered the two-phase alloys. When a grain of one phase meets two grains of a second phase, the "dihedral angle" may be anything from zero to 180°, depending on the relative value of the interphase and grain boundary energies. A low angle produces a microstructure conducive to poor mechanical properties. If the angle is zero (i.e., the interphase boundary has less than half the grain boundary energy) the minor phase will spread completely between the grains of the principal component. If the angle is below 60° it will spread continuously along grain edges, while above 60° it progressively approaches a spherical shape.

Hot-shortness results from the presence of a liquid phase with zero dihedral angle. The presence of a liquid is not necessarily dangerous, for a liquid differing greatly in composition from the crystalline phase with which it is in equilibrium often has a large interfacial energy and high dihedral angle. It is also interesting to note that the interfaces between crystals of different phases are usually of lower energy than the grain boundary between the two crystals of the same phase differing only in orientation.

Since microstructure results from surface forces and is not directly dependent on the nature of the crystals themselves, it is possible to duplicate microstructures in nonmetallic systems where surfaces reach equilibrium. The shapes of three-dimensional cells in many biological tissues, including human fat, are identical with grains in a metal, and one and two-phase structures in alloys are almost exactly duplicable by the use of froths of soap solution containing various amounts of air.

Dr. Smith demonstrated an ingenious model which showed the growth of the cells in a soap froth of low pressure following precisely the same geometry that accompanies growth of grains in a metal.

Cyril Stanley Smith (Right) Receives the Sauveur Memorial Award from Louis Geerts, Boston Chapter Chairman, With Leonard Jaffe of Watertown Arsenal Looking on. Dr. Jaffe acted as technical chairman for the Sauveur lecture presented by Dr. Smith. (Photo by H. L. Phillips)

Inland Empire Tours Washington State Institute

Reported by J. M. Marchi
Metallurgist, Permanente Metals Corp.

The Inland Empire Chapter A.S.M. held its March 15th meeting at the Washington State Institute of Technology in Pullman, Wash. The speaker of the evening was Dr. Bernard Fried who talked on "Theories of Failures and Applications in Design".

After the lecture, the members and guests were conducted on an extensive tour of the Institute, including the mining experiment station, industrial research department, engineering experiment station, mechanical engineering testing laboratory, and the school of mines and metallurgy.

Corrosion Illustrated By Movies and Slides

Reported by R. M. Spencer
Test Engineer, National Forge & Ordnance Co.

"Corrosion of Metals" was the subject of the April meeting of the Northwestern Pennsylvania Chapter A.S.M. The speaker was G. C. Kiefer, associate director of research for Allegheny-Ludlum Steel Corp.

Mr. Kiefer's discussion was preceded by a sound motion picture in color which clearly showed the causes and results of corrosion. The three different types of corrosion—intergranular, pitting, and stress-corrosion—were illustrated by some excellent examples. The talk was followed by another sound motion picture in color entitled "Corrosion Proof" which definitely showed that resistance to corrosion is caused by a very thin oxide film which covers the material.

In the lively discussion period which followed, Mr. Kiefer capably answered the many questions that were addressed to him concerning the use and fabrication of stainless steel.

Names Sales Representatives

Steel City Testing Machines, Inc., manufacturer of machines for the physical testing of metals, announces the appointment of two exclusive sales representatives. J. W. Dice & Co., Grand View-on-Hudson, New York, has been appointed to cover the middle Atlantic area. Steel City Tool & Machinery Co., Pittsburgh, has the Pittsburgh area, including western Pennsylvania, West Virginia and adjacent counties in Ohio.

Significance of Carbon Content In 18-8 Shown

Reported by J. J. Buczynski
Taylor Instrument Companies

When Russell M. Franks, development manager of the Electro Metallurgical Div. of Union Carbide and Carbon Corp., concluded his talk on the importance of carbon content of the 18-8 stainless steels, no one in his audience remained unimpressed about the significance of this relationship. In addressing the Rochester Chapter A.S.M., Mr. Franks pointed out that very few people realize fully the extent to which carbon influences the properties of 18-8.

In a brief review of the historical development of this most useful series of alloys, the speaker showed how the progressive lowering of the carbon content has resulted in expanding their production to the present total of 600,000 tons annually. This tremendous growth would not have occurred without a continued lowering of carbon content, for the early high-carbon stainless steels were difficult to work and left much to be desired in their resistance to corrosion.

In the middle thirties an intensive campaign got under way to reduce the carbon content of these steels to the lowest practical limits. As a result it became possible to produce steels on a commercial basis with as little as 0.07% carbon. At the same time experimental heats on a smaller scale had reached the amazing low of 0.01% carbon. Continued research and development through the war years has led to the present commercial availability of 18-8 with only 0.03% C.

The purpose of such work was to produce a grade of stainless which can be worked and treated, welded and formed without requiring the label of special handling, and at the same time maintain the corrosion and oxidation resistance which it inherently possesses before such treatment. The implications of the latter statement are reflected in our present inability to weld or to stress-relieve without resorting to special compositions or to full solution annealing by water quenching from 1950° F.

With 18% chromium the corrosion rate of the stainless steels is essentially a function of carbon content, despite variations from 9 to 13% in the nickel content. And to be perfectly safe in withstanding the deleterious effects of fabrication (forming, welding and stress-relieving), it is necessary to get the carbon down to 0.03%. Steels with such low carbon maintain their corrosion resistance and do not require special precautions.

Its greater austenite stability accounts for the superior characteristics of extra-low-carbon 18-8. Corrosion research has shown the deleterious effect of secondary phases in the resistance of these alloys to intergranular and general corrosion. In this connection the speaker showed how the use of too much molybdenum in 0.03% carbon 18-8 will result in decreased austenite stability.

Payson at Youngstown

At the Mahoning Valley Chapter's Meeting on April 12 in Youngstown Peter Payson, Assistant Director of Research for Crucible Steel Co. of America, Spoke on "A Modern Viewpoint in the Annealing of Steel". Mr. Payson's talk has been reported in detail in previous issues. (Photo by Henry Holberson)

Roberts Reviews Toolsteels

Reported by J. J. Buczynski
Taylor Instrument Companies

If there are people who find that high speed steel problems are still a perplexing subject, then it is not due to the efforts of men like George A. Roberts, chief metallurgist for Vanadium-Alloys Steel Co. In a concise fashion he reviewed the history, composition and properties of this indispensable alloy series before the final technical session of the Rochester Chapter A.S.M. on April 11.

After developing an introductory background for his subject, he described in greater detail some of the recent developments in the testing and application of high speed steels. Dr. Roberts' talk has been reported in detail when presented before other chapters of the society.

Shows Functions of Alloys As Ferrite Strengtheners And Carbide Formers

Reported by H. O. Nordquist
Mgr., Alloy & Stainless Steel Dept. Joseph T. Ryerson & Son, Inc.

Producers of low-alloy high-strength structural steels take advantage of the ferrite strengthening effect provided by alloying elements, D. H. Rowland, research associate, Carnegie-Illinois Steel Corp., said at a recent meeting of the St. Louis Chapter A.S.M. Dr. Rowland spoke on "Functions of Alloying Elements in Steel". So far as is known, he said, any element dissolved in ferrite increases hardness and strength in accordance with the general rule of solid solution.

Hardenability is a term frequently confused with hardness. The two are not directly related although the hardness test is a popular means of determining the depth of hardening, which is the measure of hardenability. It is the capacity of a steel to harden from the standpoint of depth of martensitic hardening upon quenching. In effect, most alloys increase the depth of hardening or hardenability.

The formation of carbides is an important factor where the steel is employed as a tool and where abrasive wear is a consideration. Nickel, cobalt, iron, and manganese are not strong carbide-formers, whereas chromium, molybdenum, tungsten, and titanium are.

A generous explanation of the isothermal transformation curves was expertly presented. Perhaps the greatest usefulness of the S curve, Dr. Rowland believes, lies in the overall picture of the transformation behavior of austenite that it represents. With the general concept in mind, many observed phenomena can be interpreted and correlated on a rational basis, so the metallurgist or heat treater can plan more intelligently the steps he must take to solve his problems. The value of the Jominy test bar in aiding the heat treater to simplify his job was also brought out.

Speak at Campus Dedication

Two of the new classroom and laboratory buildings on the campus of Illinois Institute of Technology are being dedicated during June. Scientific symposia on basic and applied science will feature the one-day ceremony in the Chemistry Building and the Metallurgical and Chemical Engineering Building. Among the speakers on the symposia are A.S.M. members Cyril Stanley Smith, director of the Institute for the Study of Metals at University of Chicago, and J. B. Austin, director of research for United States Steel Corp.

Penn State Chapter Presents First McFarland Award to G. V. Luerssen

Reported by F. R. Lorenz, Jr.
Pennsylvania State College

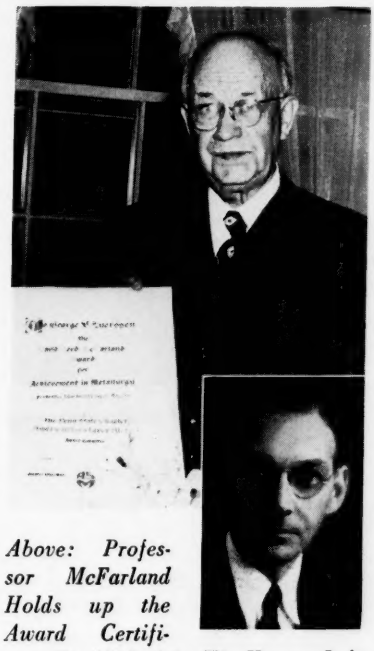
Penn State Chapter A.S.M. held its first annual McFarland Award Banquet on May 12 at the Nittany Lion Inn, State College, Pa. The first award was presented to George V. Luerssen, chief metallurgist, Carpenter Steel Co., Reading, Pa. (class of 1915, Penn State), for his contribution to the development and to the splendid reputation of his company; for his active leadership in the metallurgical profession; and for his personal record as a man and a citizen.

Among the noted guests were A. E. Focke, A.S.M. national vice-president; F. B. Foley, past president; many distinguished alumni of metallurgy at Penn State; Dean Edward Steidle of the School of Mineral Industries; and a large group of students and faculty. Master of Ceremonies was J. H. Keeler, chapter chairman. H. M. Davis, chairman of the Awards Committee, detailed the events leading up to its establishment, and then D. F. McFarland, professor emeritus of metallurgy, personally presented the first award certificate to Mr. Luerssen.

Dr. McFarland told how Mr. Luerssen has been employed by the Carpenter Steel Co. since 1907, with exception of four years' leave granted for attending Penn State. He served for two years in World War I and then returned to Carpenter, where he is now chief metallurgist.

His contributions to metallurgy have been many. He was chairman of the Lehigh Valley Chapter A.S.M. in 1929, chairman of the Melting Committee of the Metals Handbook in 1939 and 1948, general chairman of the Handbook Committee in 1948, and received the Lehigh Valley Chapter's Bradley Stoughton Award in 1945. He served on several War Production Board Committees during the past conflict.

Mr. Luerssen presented the technical address for the evening, entitled "Iron-Nickel Alloys of the Reversible Type—Over 26% Nickel". Following a few demonstrations of the peculiar magnetic and expansion properties of some of the Fe-Ni alloys at different temperatures, he showed a series of excellent slides to explain further the various theories concerning the behavior of these alloys. Commercial applications in a multitude of instruments and other products were also illustrated. Mr. Luerssen covered the range of 26 to 80% nickel, stressing the close ties of magnetism, physical metallurgy and physics to the metallurgical importance of these alloys.



Above: Professor McFarland Holds up the Award Certificate Established in His Honor. Left is G. V. Luerssen, first recipient of the award. (Photo by S. P. Jones, photographer, Penn State Engineer

Metallography Illustrated

Reported by E. R. Freeman
Permanente Metals Corp.

The Inland Empire Chapter A.S.M. held a dinner meeting on April 21 in Spokane, Wash. Speaker of the evening was L. J. Barker, metallographer for Permanente Metals Corp. Mr. Barker illustrated his lecture on "Metallography of Aluminum and Its Alloys" with many slides showing wrought and cast aluminum.

Baltimore Officers' Night

Reported by Ralph E. Vining
Revere Copper and Brass, Inc.

National Officers Night of the Baltimore Chapter A.S.M. was held on May 10. In the absence of W. H. Eisenman, President Harold K. Work gave a report of the affairs of the Society with addition of some items in lighter vein usually presented by the national secretary. For the technical part of the meeting, Dr. Work discussed "Some Factors Affecting the Behavior of Steel During Cold Work".

Howard Lynch, metallurgical supervisor of the hot and cold sheet division of the Bethlehem Steel Co., conducted the discussion. Allen Robertson gave a coffee talk on crime and crime solution with a new slant on the life of Sherlock Holmes.

Outlines Precautions For Deep Drawing Of Sheet Steel

Reported by Alexander Lesnewich
Rensselaer Polytechnic Institute

"Successful deep drawing of sheet steels is possible only with proper steel testing techniques," said Ralph W. E. Leiter, chief metallurgist, railway equipment division of the Budd Co., in his talk to the members of the Eastern New York Chapter A.S.M. on April 12. Dr. Leiter's subject was "Deep Drawing of Sheet Steel".

The speaker explained that no troubles are caused by quench aging since box annealed sheet is used for deep drawing. Strain aging, however, does present problems because the steel is lightly cold reduced as the last operation for the purpose of minimizing Lueder's lines and lowering the yield strength.

Some killed steels that were developed just prior to the war have better drawing properties and are nonaging. An optimum grain size of 100 grains per sq. in. is desired in rimmed steel because rough surfaces might be produced with coarse grained steels. If too fine grained, the yield point will be higher than desired. A larger grain size can be tolerated in killed steels.

Since deep drawing failures can be caused by either the dies or the steel, proper testing of the sheet is necessary to produce the stampings required by modern design. Dr. Leiter recommended hardness, cup, and tensile tests. The tensile test alone, if carefully made, will provide all of the information necessary for classifying the sheet.

Deep drawing steels should have low yield points and high tensile strengths, particularly as related to the yield. Dr. Leiter prefers yield strengths below 24,000 psi. and tensile strengths above 40,000 psi. for deep drawing purposes. A uniform elongation of 28% is also sought.

Dr. Leiter explained that increased press speeds are causing difficulties, since the yield strength of the sheet will increase with the stamping speed while the tensile properties will remain almost constant. As this phenomenon will lower the necessary high ratio of tensile strength to yield strength, new techniques might have to be devised to enlarge stamping mill output.

This month's coffee speaker was John Brouton, New York State geologist, who discussed the iron and titanium ore prospecting program in the Adirondacks.

Defines States of Stress in Steel

Reported by R. M. McBride
Universal Products Co., Inc.

"The States of Stress in Steel" were defined and graphically illustrated by M. Gensamer, assistant to the director of research, Carnegie-Illinois Steel Corp., before the Detroit Chapter A.S.M. on April 11.

The speaker briefly described what is meant by a state of stress (stress at a point rather than in terms of area), pointing out that there are three planes perpendicular to each other with no shear stresses. The normal stresses perpendicular to these planes are the principal stresses, with the maximum shear stress equal to one-half the difference between the greatest and least principal stresses.

Dr. Gensamer showed how combined stresses are produced, and discussed the mechanical behavior of metal under stress. The effect of notch and other design features is important, while the transition temperature depends on the way in which the metal is tested.

Initial stresses are modified by plastic deformation. If some ductility is present we worry more than is necessary unless these stresses promote corrosion. Residual or internal stresses are not the bad actors they are sometimes made out to be, Dr. Gensamer reassuringly concluded.

Seated at the speakers' table at dinner were the members of the Year Book Committee who were individually introduced by Chapter Chairman Art Smith.

Lehigh University Offers Fellowships for 1949-1950

Lehigh University, Bethlehem, Pa., has announced that two Du Pont Fellowships, one Westinghouse Fellowship, and the George Gowen Hood Fellowship, together with 35 additional fellowships and scholarships will be available for the academic year 1949-1950.

Both DuPont Fellowships (one in mechanical, one in metallurgical engineering) have a stipend of $1200 (or $1800 if the holder is married) and freedom from tuition fees. The Westinghouse Fellowship is also in mechanical engineering and provides a stipend of $1000 which may be augmented by free tuition from the University.

The George Gowen Hood Fellowship, supported by the Catherwood Foundation, provides a stipend of $1500 as well as freedom from tuition fees, and applications will be received from candidates in any fields in which Lehigh University offers work for the doctorate.

Further information and application forms are available from Dean Wray H. Congdon, director of admissions.

Dr. Gensamer at Detroit

Panel of Five Experts Answers Many Varied Questions on Titanium

Reported by R. E. Christin
Columbus Bolt and Forging Co.

A panel of five experts conducted a symposium on "Titanium and Titanium Alloys" at the May 10th meeting of the Columbus Chapter A.S.M. Howard C. Cross, newly elected chairman, served as technical chairman, with the following panel to cover specific subjects:

D. L. Day—Iodide titanium

O. W. Simmons—Production and arc melting of titanium.

R. I. Jaffee—Titanium-base alloys.

S. J. Stockett—Engineering properties of titanium.

Mars G. Fontana—Corrosion of titanium.

(The first four members of the panel are all on the staff of Battelle Memorial Institute; Dr. Fontana is professor at Ohio State University.)

Mr. Cross, in his introduction, called attention to the series of articles on titanium in the February and March issues of *Metal Progress*, but pointed out that "magazines cannot be asked questions". More than 20 questions were asked and answered by the panel during the evening. They ranged from the plastic range to the heat treating, welding and machinability of the new metal. Men from Curtiss Wright Corp. wanted to know about cladding and formability, while questions about price brought out the figures of $5 per lb. for the crude sponge and $25 per lb. for fabricated titanium.

Prior to the technical session, representatives of the sustaining members of the chapter were introduced and welcomed, and election of officers was held.

Wide Selection of Toolsteels Insures Maximum Efficiency

Reported by Thomas Haver
Standards Engineer
U. S. Naval Ordnance Plant

A wide selection of toolsteels is necessary to provide maximum efficiency at lowest cost for a particular job, C. K. Baer declared at a recent meeting of the Indianapolis Chapter A.S.M. Mr. Baer is metallurgist in charge of the Crucible Steel Co. of America's laboratory at the Sanderson-Halcomb Works.

Straight carbon toolsteels owe their popularity and wide usage to the combination of toughness and hardness which can be produced through simple heat treatment. Intricate designs, which promote residual stresses and cracking during heat treatment, should not be fashioned of carbon toolsteel but are readily adaptable to the alloy toolsteels.

Mr. Baer stressed the importance of buying the steel for the specific job. The use of oil quenching toolsteels will result in less distortion and less cracking. The 5% chromium air hardening steel is one of the most versatile special toolsteels because of its nondeforming properties, toughness, and high hardness.

High-carbon high-chromium steels were recommended in applications where good wear resistance is required, such as in dies, rolls, molds, and lathe centers. Disadvantages of these steels are their relatively low machinability and susceptibility to grinding cracks when not tempered properly.

Hot work toolsteels have the various combinations of hardness, resistance to softening, toughness and wear resistance required in tools such as gripper dies, hot heading and nosing dies.

High speed toolsteels were discussed primarily from the standpoint of obtaining maximum properties through proper heat treatment and usage, such as double tempering and annealing before any rehardening to reduce brittleness and coarse fracture.

The following practices were suggested to reduce heat treating troubles and obtain maximum properties from a steel:

1. Temper immediately after hardening or immerse parts in boiling water until they can be tempered.
2. Machine parts all over before hardening.
3. Use fillets and radii to reduce stress concentration.
4. Take advantage of good surface finish for cutting edges and wearing faces of tools to increase cutting life.

Martempering was also recommended for obtaining optimum properties from oil quenching steels.

Metal Cutting Research Improves Machinability Of Cast Iron and Steels

Reported by H. O. Nordquist

Manager, Alloy & Stainless Steel Dept. Joseph T. Ryerson & Son, Inc.

Defining machinability as the ability to cut with good tool life, low power input and a good surface finish, Michael Field, applied research director of Metcut Research Associates, Cincinnati, Ohio, spoke on "Application of Metal Cutting Research to Industry" before the St. Louis chapter on Feb. 18.

Influencing factors are the abrasive character of the metal being cut, the work hardening tendency and its shearing strength. Outside influences include cutting fluids and free-machining "additives" to the steel itself. These additives must be controlled to yield maximum benefit, the speaker pointed out; if too much or too little is used the machinability falls off noticeably.

The effect of microstructure of cast iron on its machinability was illustrated by slides. A change from pearlite to a uniform ferritic structure will improve the tool life from 10 to 100 times. Most pearlitic cast irons will machine best at about 300 surface ft. per min.

Dr. Field described a new method of making malleable cast iron with good physical properties and improved machinability, using an "additive" to the cast instead of the more expensive heat treatment. Such malleable irons as-cast with a ferritic matrix promise exceptional improvements in machinability.

Dr. Field was preceded by Clemens R. Maise, associate director of the St. Louis Police Department Laboratory, who gave a coffee talk on the "Scientific Aspects of Crime Detection".

Shows Ideal Structures For Machining Operations

Reported by W. G. Fassnacht

Assistant Chief Metallurgist Bendix Products Div.

The Notre Dame Chapter at its April meeting studied machinability under the tutelage of William Mounce, a member of the New England Technical Section of the International Nickel Co., Inc. Specifically, his talk was titled "Effect of Structure on Machinability of Steel".

A number of elements affect machinability, Mr. Mounce pointed out, including rigidity of the machine, the cutting fluid, design of the tool, speeds and feeds used, and the nature of the material being cut. The talk was concerned only with the effect of the last factor.

Metallurgical structure influences the mechanics of chip formation. The type of chip and the ease of machining will be determined by several material factors—namely the shear strength of the material being cut, the response of the material to work hardening during cutting, the friction between the chip and the cutting tool, the hardness of the material and the special nature of the microconstituents in the steel.

Strength and ductility—which in turn are determined by the structure of the steel—must both be considered in studying machinability problems. Therefore, the chemical composition of the steel affects machinability only in its influence on the type of structures developed by conditioning heat treatments.

Ideal structures for various machining operations were shown and methods of obtaining the structures were suggested.

New Welding Group Formed

Establishment of the Resistance Welding Institute, an educational organization for the dissemination of information on technical advances in resistance welding, has been announced. Lee H. Judge, industrial public relations executive, has been appointed director of the institute, with headquarters in Cleveland.

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Compliments

To GERHARD DERGE and FREDERICK N. RHINES of the department of metallurgical engineering, Carnegie Institute of Technology, on their appointment to full professorships in the college of engineering and science.

♦ ♦ ♦

To LEHIGH UNIVERSITY on the acquisition of a rare 1678 edition of Biringuccio's "The Pirotechnia", The volume was presented to GILBERT E. DOAN, head of the department of metallurgical engineering, by the Italian Foundrymen's Association.

♦ ♦ ♦

To HARRY W. MCQUAID, steel consultant, on delivering the principal speech at the dedication of the new Peirce Memorial Laboratory of Metallurgy at Stevens Institute of Technology.

♦ ♦ ♦

To the Los Angeles *Herald & Express* on the quality of its reporting of the Western Metal Congress, as indicated by the following quotation from a letter written by A.S.M. Secretary W. H. Eisenman to the editor of the newspaper: "The American Society for Metals desires to thank the *Herald & Express* for the unusual excellence of the reporting accorded the Western Metal Congress in Shrine Convention Hall. The articles, prepared by Don Ryan, were written with accuracy and with the interpretation that explained metallurgical developments to the nontechnical walks of life . . . . . Our membership is so deeply impressed I felt it incumbent upon me to forward this letter."

♦ ♦ ♦

To JOHN HOWE HALL, foundry consultant, on the presentation of the annual lecture of the American Foundrymen's Society, during its convention in May. Mr. Hall's subject was "Steel Castings in Welded Assemblies".

♦ ♦ ♦

To S. C. MASSARI, technical director of the American Foundrymen's Society, on the award of the John H. Whiting Gold Metal of the A.F.S. "for outstanding contributions in the field of ferrous metallurgy, molding and foundry practice and service to the wartime foundry industry with the Chicago Ordnance District".

♦ ♦ ♦

To GOSTA VENNERHOLM, supervisor of metallurgical research, Ford Motor Co., on the award of the Wm. H. McFadden Gold Medal of the American Foundrymen's Society "for outstanding contributions to the casting industry in the field of ferrous metallurgy and practice."

John Maloney's Cartoon in the Los Angeles Herald - Express *Brought Many Chuckles to Those Attending the Western Metal Congress last April*

260 Register for Course on Machining

Reported by G. W. Birdsall
Reynolds Metals Co.

First meeting of the series of five lectures planned for the educational course on "Machining of Metals" sponsored by the Louisville Chapter A.S.M. was attended by more than 235 men with total registration for the course exceeding 260. The series of five weekly lectures started late in March and ended on April 27.

The lead-off presentation in the series was made by M. E. Merchant, senior research physicist, Cincinnati Milling Machine Co. In his discussion of the physics of metal cutting, he pointed out that all machining operations produce one or another of three different types of chips, and explained the factors that enter into their formation.

The lecture at the second meeting was presented by H. B. Knowlton, supervisor of materials engineering, International Harvester Co., speaking on "Metallurgy and Machinability". He analyzed the effect of structure on machinability, and emphasized the things that can be done to the metal by heat treating and alloying to produce a metal easy to machine.

The third evening featured a presentation by R. L. Grun, lubrication engineer, industrial division, Gulf Oil Corp., of the topic of cutting fluids. After detailing the history and development of this field, he mentioned seven functions of cutting fluids and told how they can be accomplished.

On April 20 a highly interested audience heard George Roberts, chief metallurgist, Vanadium-Alloys Steel Co., talk on "Toolsteels" (essentially the same lecture presented before other A.S.M. chapters and previously reported). The final meeting on April 27 was a summary and discussion led by S. F. Popson of Gulf Oil Corp.

Stoughton Outlines Recent Innovations In Steelmaking

Reported by R. G. Robertson
Virginia Polytechnic Institute

"Recent Innovations in Metallurgy of Iron and Steel" were graphically described by Prof. Bradley Stoughton, retired head of the metallurgical engineering department and dean of engineering at Lehigh University. Professor Stoughton addressed the Virginia Polytechnic Institute Chapter A.S.M. on April 4.

Discussing the availability of iron ore in North America, Prof. Stoughton mentioned the possible use of taconite ores, foreign ores, and the rich ore field in the Labrador-Quebec area.

The latest developments in the blast furnace are the high-pressure top, turbo blowers, and the use of oxygen-enriched blast. The productivity of the blast furnace is dependent on the speed of burning of the fuel, the speaker pointed out. Blast penetration is aided by the high-pressure top, and the increased rate of burning of coke with less heat loss out of the top is enhanced by the use of oxygen. These are contributing factors to the increased capacity of the furnaces.

Oxygen is being used to increase the output of all types of metallurgical furnaces, and cupolas are being used to provide melted metal as raw material for openhearth furnaces.

In the bessemer converter, there are two operations to be watched with interest, namely, the desulphurizing of the raw material (pig iron) by use of soda ash, and the dephosphorizing of the steel by the process used at Wheeling, W. Va.

The continuous casting process eliminates a great deal of the waste encountered in the ingot stage of steelmaking, and Prof. Stoughton described briefly the steps and equipment used in this new field of steel fabrication.

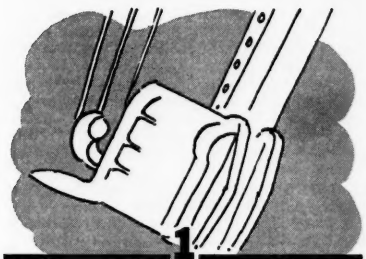
Cladding of steel to increase its resistance to corrosion is rapidly coming to the front. In this process, a thin layer of corrosion resistant metal is welded to the main sheet of steel during the rolling operation, thus combining the high strength of steel with the corrosion resistance of the cladding metal.

Prof. Stoughton closed his talk with a few remarks about recent progress in nondestructive testing.

A. S. M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received During the Past Month

Prepared in the Library of Battelle Memorial Institute, Columbus, Ohio
Ralph H. Hopp, Librarian *W. W. Howell, Technical Abstractor*



1 ORE BENEFICIATION and RESERVES

1A—General

1A-30. Laboratory Ore Testing Procedure. Part II. Clarence Thom and Frank A. Seeton. *Deco Trefoil*, v. 13, Mar.-Apr. 1949, p. 5-8.

Deals primarily with flotation test procedures.

1A-31. An Accounting of World Mining for 1948. Charles Will Wright. *Mining World*, v. 11, Apr. 15, 1949, p. 27-28, 30, 33-34.

A brief technological and economic survey of mining, mineral production, and ore beneficiation.

1A-32. Analyzer Aids Electrostatic Research. Shiou-Chuan Sun. *Engineering and Mining Journal*, v. 150, May 1949, p. 90-91.

The construction and operation of a distribution analyzer for electrostatic separation. Particles from the separator are collected in as many as 60 compartments instead of the former two or three.

1B—Ferrous

1B-26. Effect of Sized and Sintered Mesabi Iron Ores on Blast-Furnace Performance. H. F. Dobscha. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 49-57; discussion, p. 57-67.

Economical and productive gains derived at blast furnaces from size preparation of Mesabi ores are substantial. It is apparent that blowing equipment of sufficient capacity will be necessary to realize full benefits from beneficiated burdens. Consideration of hydraulic or other improved methods of screening is recommended since poor furnace operation occurred when the plus 20-mesh material in the agglomerates was substantially under 90%.

1B-27. Proposed Flowsheet for Taconite Concentration at Babbitt. H. K. Martin. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 68-72; discussion, p. 72-82.

Proposed flowsheet based on experimental work at Mines Experiment Station in Minneapolis for a taconite deposit averaging 24% Fe in the form of magnetite.

1B-28. Features of the Sintering Plant at Wisconsin Steel Works. Paul R. Nichols. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 83-86.

Illustrative of practice at a sintering plant of earlier design.

1B-29. Operations and Practice, Campbell Sintering Plant. D. P. Cromwell. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 86-88; discussion, p. 89.

Equipment and procedures.

1B-30. Sintering Plant and Practice at Steubenville. Guy Wehr. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 89-94.

Equipment, layout, and procedures.

1B-31. Sintering Practice at Fontana, California. J. D. Saussaman. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 95-106.

Plant and its equipment. Data on performance, and crushing and grinding flowsheet.

1B-32. Operating Features and Practices at the Bethlehem Sintering Plant. A. H. Fosdick. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 106-118; discussion, p. 118.

1B-33. Operating Features at the Zug Island Sintering Plant. Charles P. Betz. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 118-122; discussion, p. 122-126.

Discussion includes "Summary of Achievements", by M. F. Morgan; "Factors Governing Design of Sintering Plants", by E. W. Shallock; "Sintering Plant on a Small Site", by T. W. Plante; and "Sintering Practice of Inland Steel", by C. B. Sheets.

1B-34. Brazil's First Sintering Plant Now in Operation at Monlevade, Minas Gerais. *Blast Furnace and Steel Plant*, v. 37, Apr. 1949, p. 445-446.

1B-35. Iron Ore Sintering. H. U. Ross. *Canadian Mining Journal*, v. 70, Apr. 1949, p. 79-84.

Principles of process used to agglomerate fine iron lost from the blast furnace so it can be recharged. The various types of sintering equipment in commercial use.

1B-36. Iron Ore Beneficiation. Francis X. Tartaron. *Mining Engineering*, v. 1, sec. 1, May 1949, p. 14-18.

Various processes and the future of beneficiation.

1B-37. Iron Ore Blending Operations of Geneva Steel Company in Utah. C. L. Waggoner. *Skillings' Mining Review*, v. 38, May 14, 1949, p. 1, 4. A condensation.

1C—Nonferrous

1C-33. Investigation of Claim Point Chromite Deposits, Kenai Peninsula, Alaska. R. S. Sanford and J. W. Cole. *U. S. Bureau of Mines*, Report of Investigations 4419, Mar. 1949, 11 pages.

Section on beneficiation; nature of the ore and methods of concentration.

1C-34. Source Materials for Nuclear Power. Roland D. Parks. **"The Science and Engineering of Nuclear Power." Vol. II.** Addison-Wesley Press, Cambridge, Mass., 1949, p. 1-18.

Location of various deposits of uranium and thorium in the U. S. and abroad. Sources of other materials required for production of nuclear energy (B, Be, Bi, Pb, He, Cd, Hg, Na, K, and graphite).

1C-35. Milling Practice on the Golden Mile. S. G. Salamy. *Mine & Quarry Engineering*, v. 15, Apr. 1949, p. 101-106.

Metallurgical practice at an important Australian gold field. Description of mineralogy and mining practices. Flowsheets illustrate methods of treating the various ores. Possible alternative processes.

1C-36. Fluo-Solids Roasting of Arsenopyrite Concentrates at Cochenour Willans. Owen Matthews. *Canadian Mining and Metallurgical Bulletin*, v. 42 *(Transactions of the Canadian Institute of Mining and Metallurgy*, v. 52), Apr. 1949, p. 178-187.

Use of new "fluidized" technique for roasting. The reactor has demonstrated its ability to roast a flotation concentrate containing arsenopyrite, pyrite, stibnite, small quantities of other sulfides, and some lime silicates and carbonates, yielding a calcine consisting mainly of porous iron oxide, plus gold values. This calcine is readily amenable to cyanidation.

1C-37. Effects of Rod Mill Speed at Tennessee Copper Company. J. F. Myers and F. M. Lewis. *Mining Engineering*, v. 1, sec. 3, May 1949 (*Mining Transactions*, v. 184), p. 131-132.

Relative power efficiency of fast and slow rod-mill speeds on ores. Tests were made under normal operating conditions.

1C-38. Minerals for Chemical and Allied Industries. Part XXXI. Sydney J. Johnstone. *Industrial Chemist and Chemical Manufacturer*, v. 25, Apr. 1949, p. 243-247.

Concluding article of series deals with zirconium and its compounds —their sources, methods of recovery, uses, and specifications. Ceramic, refractory, and metallurgical uses.

1C-39 (Book). **Handbook of Uranium Minerals: A Guide for the Prospector and Miner. Ed. 2.** Jack De Ment and H. C. Dake. 96 pages. 1948. Mineralogist Publishing Co., 329 Southeast 32nd Ave., Portland 15, Ore.

A descriptive catalog of the uranium and thorium minerals, including their occurrence, detection, location, and exploration.

1D—Light Metals

1D-5. The System Aluminum Sulfate-Sulfuric Acid-Water at 60°. Jack L. Henry and G. Brooks King. *Journal of the American Chemical Society*, v. 71, Apr. 1949, p. 1142-1144.

Part of a study being made in connection with the development of an alumina-from-clay extraction process. 14 ref.

1D-6. A Brief Description of Shantung Bauxite and Extraction of Alumina by the Wet Process. H. I. Yuan, F. C. Kou, and Y. O. Huang. *Science & Technology in China*, v. 2, Apr. 1949, p. 21-24.

2 SMELTING, REDUCTION and REFINING

2B—Ferrous

2B-128. The Use of Oxygen for Steel-Making. A. G. Robiette. *British Chemical Digest*, v. 3, Mar. 1949, p. 166-170. Translated and condensed from *Kjemi, Bergvesen og Metallurgi*, v. 8, June 1948.

Use to improve combustion conditions in openhearth process; to assist in degree and speed of refining in the openhearth and the electric arc furnace; to enrich the blast in the bottom or side-blown converter; and to convert pig iron into steel by a blowing process.

2B-129. Some Correlations Between Variables Affecting Sulphur in Blast-Furnace Iron. T. E. Brower and B. M. Larsen. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 28-39; discussion, p. 39-48.

Previously abstracted from *Metals Technology*, item 2b-210, 1949.

2B-130. Some Effects of Deoxidation Treatments on Graphitization of White Cast Iron. Richard W. Heine. *American Foundrymen's Society*, Preprint 8, 1949, 14 pages.

Some effects produced when the deoxidizers Al, Ti, and H_2 are added to white cast irons. Eutectic, sulfide inclusions are produced when the point of complete deoxidation is reached, and oxygen content of white cast iron is considerably higher than heretofore reported. The number of graphite nodules developed during first-stage graphitization is shown to decrease initially with small deoxidizing additions and then to increase rapidly as complete deoxidation is attained with formation of a floccular rather than a nodular type graphite. The roll of oxygen in malleabilization is indirectly demonstrated.

2B-131. The Addition of Oxygen to the Cupola Blast. J. Blakiston. *Foundry Trade Journal*, v. 86, Mar. 31, 1949, p. 289; discussion, p. 289-290.

Potential savings, modified cupola design, advantages, and disadvantages.

2B-132. Rapid Refining by the Ugine-Perrin Method. Albert M. Portvin. *Metal Progress*, v. 55, Apr. 1949, p. 475-481. Translated from the French.

Fine-grained, high-quality steel (exceedingly low in sulfur, oxygen, and visible inclusions) is rapidly and economically produced by using the electric furnace as a melter, slagging off, adding the required alloying elements, and pouring into a ladle containing about 0.1 its weight of specially formulated slag. Adequate refining occurs in the few minutes required to move the receiving ladle to the teeming platform. The process has been in commercial use for a number of years in France and other foreign countries.

2B-133. Effect of Slag Types on Heat Treatment of Malleable Iron. G. Vennerholm and H. N. Bogart. *American Foundryman*, v. 15, Apr. 1949, p. 96-97.

Development of straight electric-furnace melting as a source of white iron for production of malleable iron. The initial investigation consisted of correlating the heat histories, including slag conditions; the heat treat susceptibility of representative castings from these heats: and structure, metallographical and fracture, of the castings. Optimum susceptibility to heat treatment could be obtained by finishing all heats under slags containing less than 18% FeO. Control procedure based on slag color.

2B-134. Oxidizing Steel Heats With Oxygen Gas. *American Foundryman*, v. 15, Apr. 1949, p. 102. Condensed from *International Digest*, Sept. 1948.

Information on use of oxygen gas instead of iron ore as an oxidizing agent in making electric steel.

2B-135. Investigations Relating to Scaffolds in Blast-Furnaces. G. R. Rigby. *Journal of the Iron and Steel Institute*, v. 161, Apr. 1949, p. 295-300.

A scaffold is defined as a deposit on the internal walls of the blast furnace which reduces the cross-sectional area of the furnace. An investigation of their composition and characteristics. Possible mechanisms of formation and methods for their minimization.

2B-136. Production of Bessemer Steel. H. W. Graham. *Steel*, v. 124, Apr. 11, 1949, p. 90-92, 94, 96, 98; Apr. 18, 1949, p. 114, 116, 118, 120; Apr. 25, 1949, p. 102, 104, 107, 110, 112, 114.

Development since 1860. Size of converters has been increased, various mechanical control means have been proposed and tried, and efficiency of the process has been increased through a more thorough understanding of the thermochemical reactions which take place. Modern converter and production procedure.

2B-137. New Brazilian Sintering Plant Utilizes Waste Charcoal as Fuel. *Steel*, v. 124, Apr. 18, 1949, p. 96.

Plant layout of Belgo-Mineira, steel producer in Brazil. Its unique method of sintering and its use of waste charcoal.

2B-138. The Turbo-Hearth—A New Steelmaking Technique. E. C. Bain and H. W. Graham. *Iron Age*, v. 163, Apr. 21, 1949, p. 62-65.

Development of a method for rapid production of steel of openhearth quality, low in nitrogen and phosphorus. The analysis is achieved by turbulence produced by jets of air impinging on a bath of liquid pig iron. The method has been tested in a 1000-lb. basic-lined experimental unit. Primary advantages of the openhearth and the bessemer are said to be combined.

2B-139. Turbo-Hearth Steelmaking Combines Benefits of Bessemer and Open Hearth. *Steel*, v. 124, Apr. 25, 1949, p. 98.

Process to produce steel low in phosphorus and nitrogen from basic pig iron in a partly closed side-blown vessel using extra heat from more complete combustion of carbon.

2B-140. Progress Report on Nodular Iron. Charles O. Burgess. *Foundry*, v. 77, May 1949, p. 112-115, 218, 220-222, 224-225, 228, 230.

2B-141. The Deoxidizing Properties of Vanadium. (In Russian.) A. M. Samarin and A. Yu. Polyakov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 100-113.

Method of investigation and composition of basic charge. Simultaneous presence of silicon inhibits the deoxidation process. Results permit determination of the thermodynamic function of oxidation of vanadium in liquid iron.

2B-142. More Steel for the Southland. Ralph G. Paul. *Western Machinery and Steel World*, v. 40, Apr. 1949, p. 70-74.

Equipment and procedures of Los Angeles plant of Bethlehem Pacific Steel Co.

2B-143. Equipment for Extracting Ingots From Their Molds. H. W. Ball. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. 116-120; discussion, p. 120-121.

Functions and design of stripper crane.

2B-144. The Application of Slag Control to the Manufacture of Tube Steel. J. Monaghan. *Engineering*, v. 167, Apr. 1, 1949, p. 294; Apr. 15, 1949, p. 343. A condensation.

Details of methods applied by a British firm.

2B-145. The Equilibrium Between Liquid Silica and Liquid Iron. J. D. Fast. *Philips Research Reports*, v. 3, Aug. 1948, p. 271-280.

Welding-rod coatings contain as a rule a large proportion of SiO_2 and, for that reason, the above equilibrium is of importance in arc-welding technique. The reaction constant for the equilibrium between the pure substances is computed from thermodynamic data and the results obtained are applied to study of actual equilibrium conditions under various circumstances. 15 ref.

2B-146. Der Gefugeaufbau der Eisenoxyd-Silikate, der Rennfeuer-u. Stuckofenschlacken und die Vorgänge bei der Ausscheidung des metallischen Eisens aus solchen Schlacken. (Structures in the Iron Oxide-Silica System, and in Direct-Process and Lump Slags; and Reactions Occurring During Precipitation of Metallic Iron From These Slags.) B. Neumann and

H. Klemm. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 7-11.

Surveys the literature; the chemical character of blast-furnace slags, the FeO-Fe_2O_3-SiO_2 constitution diagram, the constituent parts of the hardened slags; and the metallurgical principles of direct-process malleable-iron production.

2B-147. Bedeutung physikochemischer Gleichgewichtsuntersuchungen fur die Erzreduktion. (Importance of Physicochemical Research on Equilibrium Conditions in Ore Reduction.) Josef Klärding. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 1-4.

As related to iron-ore reduction. The Fe-O_2-C and the C-O_2 diagrams are shown to be the basis of the reduction with solid carbon. On the basis of the study, it was found that calcining with a small amount of lime increases the amount of readily reducible iron oxide. Practical results are lower coke consumption, higher capacity, and larger amount of indirect reduction in the blast furnace. It was not found possible to apply the results to magnetic roasting, carbonate roasting, or removal of arsenic from oxide iron ores. 25 ref.

2B-148. Die metallurgischen Grundlagen des Hochofenprozesses. I. Das Verhalten des Schwefels. Teil A. Zur Entschweflung des Roheisens uber gasförmiges Siliziumsulfid. (The Metallurgical Principles of Blast-Furnace Operations. I. The Effect of Sulfur. Part A. Desulfurization of Pig Iron by Forming Gaseous Silicon Sulfide.) Willy Oelsen and Helmut Maetz. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 53-58.

Investigated by adding ferrosilicon and quartz sand to sulfur-containing pig iron. Results show that more than 10% Si is required to reduce the S content to below 0.05%. 26 ref.

2B-149. Finished Steel Production; Possible Increase From Existing Equipment. R. F. Passano. *American Iron and Steel Institute,* Preprint, 1949, 23 pages.

Steel industry can produce more finished product without appreciable expansion of existing plants. Practices that decrease losses in material and time between ladle and finished hot rolled products.

2B-150. Studies Relating to the Control of Sulphur in the Production of Pig Iron. Truman H. Kennedy and Arthur W. Thornton. *American Iron and Steel Institute,* Preprint, 1949, 21 pages.

Problem of removal of sulfur introduced by the coke. Increased amounts of slag required for increased percentages of sulfur. Results of experiments on the most effective range of slag compositions, within limits set by available materials. Effects of variations in coke sulfur and in dolomite content of slag. Substitution of dolomite for limestone improves desulfurization up to 5-8% magnesia in the slag. Ratio of sulfur in slag to sulfur in iron is shown to be a useful desulfurization index.

2B-151. Increasing Open Hearth Production by Use of Oxygen, Better Refractories and Control of Slag. Erle G. Hill. *American Iron and Steel Institute,* Preprint, 1949, 16 pages.

2B-152. The Chemistry of Metallurgical Slags. N. J. Grant and John Chipman. *American Iron and Steel Institute,* Preprint, 1949, 18 pages.

Includes the various methods of slag analysis, for estimation of lime-silica ratios, and for measuring basicity by means of various slag-concentrate ratios. Ionic theory of slags. 28 ref.

2B-153. Simultaneous Manufacture of Cement and Cast Iron. K. Koyanagi. *Rock Products,* v. 52, May 1949, p. 60-62.

Unusual process (the Bassett process) first introduced by a Spanish company in 1931-1935. During the war the process was tried by three large plants in Japan. Procedures and results of the latter work. 100 parts of pyrite cinder, 120-130 parts limestone, and 60-70 parts coke breeze were found to give the best results. The clinker is ground and separated by air and magnetic separators into cement and powdered iron. The latter has a composition similar to gray iron. The cement, although it contains some unseparated iron, has normal setting time and good strength.

2B-154. Desulfurizing Hot Metal. *Iron Age,* v. 163, May 12, 1949, p. 83. Based on paper by E. P. Best.

Ladle-desulfurizing method said to be the most effective means, on a commercial scale, for bringing molten metal and molten desulfurizer in contact. It is featured by a reladling operation under controlled conditions and results in a very effective association of molten metal with NaOH as the desulfurizer, making possible 90-95% sulfur removal.

2B-155. Intermittent Oxygen Enrichment of the Cupola Blast. E. N. Harrison and J. A. Wagner. *Iron Age,* v. 163, May 12, 1949, p. 96-100.

Value as a method for maintaining optimum temperature and melting rates on basis of experience of a gray-iron shop, producing thin-section castings, with 4% enrichment for 2-4 min. periods. Effect of the addition on the lining, and cost of the oxygen.

2B-156. (Book) **Seventy-Five Years of Progress in Iron and Steel; Manufacture of Coke, Pig Iron, and Steel Ingots.** C. D. King. 184 pages. 1948. American Institute of Mining and Metallurgical Engineers, 29 West 39th St., New York 18, N. Y.

Outlines history. 144 ref.

2B-157. (Book) **Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers** (v. 7, 1948). 178 pages. 1949. The Institute, 29 W. 39th St., New York 18, N. Y.

A compilation of papers and discussions presented at a conference held in Pittsburgh, Apr. 12-14, 1948. Sessions were devoted to coke and iron quality, iron-ore beneficiation, sintering-plant design and operation, and blast-furnace hearth construction. The individual papers are abstracted separately.

2C—Nonferrous

2C-23. Electroseparation of Technetium From Rhenium and Molybdenum. L. B. Rogers. *Journal of the American Chemical Society,* v. 71, Apr. 1949, p. 1507-1508.

2C-24. Transition of Sulfur, Contained in the Charge, Into Calcium Sulfide During Smelting. (In Russian.) V. I. Lukashin. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 131-135.

The formation of the less stable compound CaS, soluble in slag and insoluble in metal, from the more stable compound CaO with reference only to the interaction of lime with sulfur vapor. Method of experiment and apparatus used.

2C-25. Arc Melting Refractory Metals. S. A. Herres and J. A. Davis. *Steel,* v. 124, May 2, 1949, p. 82-86, 135.

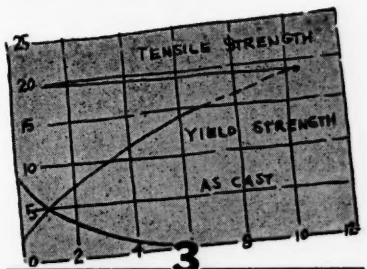
Laboratory arc-melting furnace used for experimental investigation of alloys of Ti, Zr, Cr, Mo, or W. Consists of an enclosed water-jacketed copper crucible and a vertically movable, water-cooled, tungsten-tipped electrode.

2D—Light Metals

2D-14. Fluxing of Aluminum Alloys. *American Foundrymen's Society,* Preprint 41, 1949, 3 pages.

Report of Sand Casting Committee, Aluminum and Magnesium Div. Removal of oxides and degassing. The materials used for each with respect to their relative merits. Precautions are also considered.

For additional annotations indexed in other sections, see:
8-100



3 PROPERTIES

3A—General

3A-90. Considerations sur l'électrochimie des métaux. (Discussion of the Electrochemistry of Metals.) R. Piontelli. *Journal de Chimie Physique et de Physico-Chimie Biologique,* v. 45, June 1948, p. 115-122.

An important group of electrochemical properties of metals such as oxygen affinity, polarizability (anodic and cathodic), polarographic behavior. Attempt is made to interpret these properties more comprehensively. 17 ref.

3A-91. Plastic Stress-Strain Relations. W. M. Shepherd. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 39, 1948, p. 95-99; discussion, p. 99-114.

Relations applicable to problems in which elastic and plastic strains are of comparable magnitude. Two alternative criteria are used, one based on the Mises-Hencky function and the other on the maximum shear stress. Shear-stress-shear-strain curves are deduced from tensile-stress-strain curves and the result in one case compared with experiment. The problem of a thin tube strained in tension beyond the plastic region and then subjected to an increasing torque, and the tensile and shear strains due to the torque.

3A-92. Quelles sont les propiétés fondamentales essentielles permettant de caractériser les propiétés mécaniques des matériaux? (Which of Their Fundamental Properties Are Essential to Characterization of the Mechanical Properties of Materials? Carl Benedicks. *Revue de Métallurgie,* v. 46, Jan. 1949, p. 1-6; discussion, p. 6-7.

Proposes a simplified diagram for determining the above, based on four fundamental parameters: elastic limit, maximum elongation without permanent deformation, yield point (maximum tensile strength), and maximum elongation before fracture. 24 ref.

3A-93. Application of Reaction Rate Principles to Some Mechanical Properties of Materials. Edward Saibel. *Transactions of the New York Academy of Sciences,* ser. 2, v. 11, Feb. 1949, p. 135-147.

How the above has been accomplished in several cases. Such phenomena as creep, viscosity, and fatigue can only be fully explained by application of physical principles analogous to those of chemical reaction. Discussion of theory of the rate of propagation of fracture cracks in metals. 18 ref.

3A-94. Thermal Contact Resistance of Laminated and Machined Joints. A. W. Brunot and Florence F. Buckland. *Transactions of the American Society of Mechanical Engineers,* v. 71, Apr. 1949, p. 253-256; discussion, p. 257.

Values for two types of joints: between two blocks of laminated steel, either in direct contact or separated by cement or shims of steel, aluminum, or aluminum foil; and between two blocks of cold rolled steel with various surface finishes. The resistance measured amounts to 0.3 to 8 in. of additional material depending upon configuration. Results in terms of contact resistance.

3A-95. Thermal Resistance Measurements of Joints Formed Between Stationary Metal Surfaces. N. D. Weills and E. A. Ryder. *Transactions of the American Society of Mechanical Engineers,* v. 71, Apr. 1949, p. 259-266; discussion, p. 266-267.

Results of measurements on dry and oil-filled joints between two flat surfaces of various metals. Thermal resistance is decreased by increasing temperature and pressure, by inclusion of oil, or by plating the surfaces with a soft metal.

3A-96. Influence d'un champ magnétique sur le frottement interieur des ferronickels réversibles. (Influence of Magnetic Field on the Internal Friction of Reversible Ferronickels.) Charles Apert and Robert Cabarat. *Comptes Rendus,* v. 228, Feb. 7, 1949, p. 490-492.

Investigated on test specimens with 30-90% Ni content, and annealed at 800° C. for 7 hrs. at atmospheric pressure. Internal friction rapidly increases for low values of magnetic field, reaches a maximum, then decreases to practically a constant value at 300 oersteds. Influence of Ni content.

3A-97. Die technische Magnetisierungskurve. (The Technical Magnetization Curve.) Walther Gerlach. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 91, Mar. 15, 1949, p. 127-133.

"Technical magnetization" is defined as the condition resulting from spontaneous magnetization by external magnetic fields. Stress-conditioned direction of spontaneous magnetization, the "180° processes", the Barkhausen Effect, the Sixtus-Tonks effect, and the Matteucci effect. Normal magnetization curve and heat of hysteresis are explained, and "technical magnetization" reactions are analyzed on the basis of changes in electrical resistance. Practical applications of the research.

3A-98. The Seizure of Metals. F. P. Bowden and D. Tabor. *Engineer,* v. 187, Apr. 8, 1949, p. 395-397. A condensation.

Mechanisms involved. Part played by localized welding at points of intimate contact, with the consequent formation of metallic junctions between surfaces. This welding is due largely to intense local pressure which produces plastic flow at the summits of surface irregularities. Even under static conditions, or at low sliding speeds, intermetallic junctions may be formed by "cold welding" and strong adhesion may occur. Effects of oxide films, of soft metals, of boundary lubricants, or of hard metallic films in reducing localized adhesion and seizure. 18 ref.

3A-99. Elastizität Fester Körper. (Elasticity of Solids.) Werner Köster. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 119-125.

Reviews German contributions, 1939-1946, to measurement of modulus of elasticity, measurements of single crystals, effects of different factors on the modulus, and general considerations. 34 ref.

3A-100. Plastizität Kristalliner Stoffe. (Plasticity of Crystalline Substances.) Albert Kochendörfer. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 126-143.

Reviews German contributions during 1939-46 on forming of single and polycrystals. 72 ref.

3A-101. Härte Fester Körper. (Hardness of Solids.) Theodor Pöschl and Helmut Buckle. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 144-153.

Reviews German contributions of 1939-46 to macro and microhardness and their measurement. 28 ref.

3A-102. Wärmeleitung in Festen Körpern. (Heat Conduction in Solids.) Walter Meissner and Gerhard U. Schubert. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 212-220.

Reviews German contributions during 1939-46, including methods of determination. 38 ref.

3A-103. Diffusion in Festen Körpern. (Diffusion in Solids.) Werner Braunbek. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 221-228.

Reviews German contributions for the period 1939-46, including investigation methods, diffusion of gases in solids, diffusion of solids in each other, practical diffusion problems, and theory of diffusion. 53 ref.

3A-104. Magnetische Eigenschaften Nichtferromagnetischer Körper. (Magnetic Properties of Non-Ferromagnetic Bodies.) Walter Klemm and Eckhardt Vogt. "Physics of Solids" *(Office of Military Government for Germany),* Part II, p. 1-26.

German contributions during 1939-46. Covers both metallic and nonmetallic substances. 76 ref.

3A-105. Ferromagnetismus. (Ferromagnetism.) Richard Becker. "Physics of Solids" *(Office of Military Government for Germany),* Part II, p. 27-42.

German contributions during 1939-46. Deals mainly with theory. 23 ref.

3A-106. Elektrizitätsleitung in Metallen. (Conduction of Electricity in Metals.) Gerhard Hettner. "Physics of Solids" *(Office of Military Government for Germany),* Part II, p. 123-130.

German contributions during 1939-46 on theory, experimental methods, and new data. 47 ref.

3A-107. High-Temperature Properties of Rotor Disks for Gas Turbines as Affected by Variables in Processing. J. W. Freeman, Howard C. Cross, E. E. Reynolds, and Ward F. Simmons. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 555-588; discussion, p. 589-590.

Previously abstracted from Advance Reprint. See item 3A-52, 1949. 14 ref.

3A-108. An Experimental Study of the Influence of Various Factors on the Mode of Fracture of Metals. P. G. Jones and W. J. Worley. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 648-662; discussion, p. 663.

Previously abstracted from preprint. See item 3a-56, 1948.

3A-109. Dynamic Torsion of Metals and Alloys Used in Aircraft Construction. Part III. Their Elastic Limit and Micro-Plastic Deformation Under Reversed Torsional Energy Loads. (Concluded.) Georges Welter. *Metallurgia,* v. 39, Apr. 1949, p. 313-315.

Data obtained by use of the special test apparatus described in the previous installments, including results for monel, tabulated in comparison with duralumin, a Mg alloy, and two steels. The Bauschinger effect is quite large for most materials.

3A-110. (Book) **Physik der Festen Körper.** (Physics of Solids.) Parts I and II. Georg Joos, editor. 228 and 235 pages. 1947 and 1948. Office of Military Government for Germany. (FIAT Review of German Science, 1939-1946.)

Part of a series prepared by German authors. General, metallic, and nonmetallic phases are covered. Largely a review of German literature for 1939-1946. Individual articles are abstracted separately.

3A-111. (Book) **Leitfähigkeit und Leitungsmechanismus fester Stoffe.** (Conductivity and the Conduction Mechanism in Solid Materials.) Eduard Justi. 348 pages. 1948. Vandenhoek und Ruprecht, Göttingen, Germany. 15 DM.

Presents the views of modern physics on this subject by discussing conductivity in terms of moving electrons and reviewing all other phenomena through which the dynamics of electrons in crystals are accessible to observation, such as the Hall effect, thermoelectricity, superconductivity, rectification in surface layers, semiconductors, photoconductivity, ionic conductivity of crystals, etc. A review of experimental work. Theories are not presented in full, but theoretical results are freely quoted. There is an elementary introduction to the wave mechanics of electrons in metals. (From review in *Nature.)*

3B—Ferrous

3B-75. Die magnetische Nachwirkung bei verschiedenen Sorten von Siliziumeisen. (The Magnetic After-Effect in Different Types of Silicon-Iron.) Hans Wilde and Georg Bosse. *Frequenz,* v. 2, Aug. 1948, p. 214-215.

A preliminary report. Magnetic after-effect at different temperatures.

3B-76. The Criterion of "Yield" of Gun Steels. J. L. M. Morrison. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 39, 1948, p. 81-94; discussion, p. 99-114.

Tests on standard Ni-Cr-Mo gun steel. The standard gun steel in the form of bars, shows a drop in stress at the yield point; the same steel in the form of forgings does not, nor do any of the alternative steels. In the first case, the criterion for the occurrence of the initial yielding was found to be the existence of a critical maximum shear stress; plastic flow continues in accordance with the Mises-Hencky criterion. In all the other steels, plastic flow occurs and continues in accordance with the same criterion.

3B-77. A Comparison of Some Carbon Molybdenum Steels on the Basis of Various Creep Limits. A. E. Johnson and H. J. Tapsell. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 40, 1948, p. 165-171; discussion, p. 172.

An experimental study of the re-

lationship between short-time and long-time creep limits has been carried out on six C-Mo steels, and the results obtained indicate similar limitations in the applicability of short-time creep limits to estimation of design stresses for long-time service, as disclosed by prior tests on carbon steels. No reason is apparent for the correlation of short and long-time creep limits.

3B-78. Theory of the Coercive Force of Steels. (In Russian.) E. Kondorskii. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Dec. 11, 1948, p. 507-510.

The influence of inclusions on the critical field and coercive force was investigated theoretically using a different approach from that commonly used. New formulas are derived for the calculation of the critical field. Obtained data are in agreement with those resulting from experimental investigation.

3B-79. Aciers russes de remplacement pour matrices d'estampage et coquilles de coulée sous pression. (Substitute Russian Steels for Stamping Dies and for Die-Casting Molds.) G. L. Livshits. *Circulaire d'Informations Techniques,* v. 6, Jan. 1949, p. 10-14. Translated and condensed from *Stal* (Steel), v. 8, Feb. 1948, p. 153-156.

Chemical composition and mechanical properties of above steels specially developed for saving critical materials, particularly tungsten. Basic composition is 0.38-0.55% C, 0.40-1.65% Mn, 0.80-1.70% Si, 2.5-12.5% Cr, 0.80-1.80% W, 0.20-0.40% V, and less than 0.30% Ni. Tungsten may be replaced by Mo (0.40-0.90%). Optimum conditions of heat treatment are indicated.

3B-80. La conductibilité thermique des aciers entre 500 et 900° C. (Thermal Conductivity of Steels Between 500 and 900° C.) *Circulaire d'Informations Techniques,* v. 6, Jan. 1949, p. 21-27.

Consists mainly of tables of data collected from eight literature sources on a wide variety of steels.

3B-81. Effect of Aluminum and Vanadium on Toughness of High Hardenability Cast Steels. J. F. Wallace. *American Foundrymen's Society,* Preprint 2, 1949, 12 pages.

Object was to compare effects of the above when used as grain refiners, on the toughness of fully quenched and drawn samples from three cast steels of high hardenability. The chemical compositions were all low in carbon and included low, medium, and high Mn steels alloyed with varying amounts of Ni, Cr, and Mo. 18 ref.

3B-82. Unappreciated Advantages of Gray Iron. Frederick G. Sefing. *Canadian Metals and Metallurgical Industries,* v. 12, Apr. 1949, p. 16-19.

Properties of the various grades. Advantages and limitations. Corrosion data.

3B-83. Notch Sensitivity of Steel Evaluated by Tear Test. Noah A. Kahn and Emil A. Imbembo. *Welding Journal,* v. 28, Apr. 1949, p. 153s-165s; discussion, p. 165s-166s, 177s.

Notch-sensitivity characteristics of plate steels consisting of rimmed, semi-killed, and fully killed medium steel in thicknesses up to 1¼ in. Effect of variations in specimen geometry and plate thickness, effect of nitrogen content, and applicability of the tear-test method to quality control.

3B-84. Transition Temperatures of Structural Steels. Effects of Geometry and Welding on High Yield Strength Steels. A. Boodberg and E. R. Parker. *Welding Journal,* v. 28, Apr. 1949, p. 167s-177s.

Various tests on high-yield-strength structural steels. Specimens were tested in tension at various temperatures. Auxiliary tests were conducted to determine the effect of welding on their behavior.

3B-85. Brittle Fracture in Ship Plate. G. Vedeler. *Engineering,* v. 167, Apr. 1, 1949, p. 289-290.

Critical analysis of recent work from the point of view of a ship designer. Confined to the brittle fracture due to triaxial stresses caused by a discontinuity.

3B-86. Influence of Short-Time Overloading on the Yield Point of Steel. (In Russian.) G. I. Pogodin-Alekseev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 91-95.

Investigated for structural steel. Results indicate the inadequacy of previous research on this subject. Curves showing the influence of time of overloading on the yield point and the dependence of critical time of overloading on the overloading value in per cent.

3B-87. Temperature Variation and Temperature Hysteresis of the Magnetic Anisotropy of Meteoric Iron. (In Russian.) L. V. Kirenskii. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 11, 1949, p. 191-194.

Theory and data.

3B-88. Grain-Size Properties of Some Railway Steels. B. R. Nijhawan. *Journal of Scientific & Industrial Research,* v. 8, Feb. 1949, p. 39-48.

Old and new railway steels, partially or fully deoxidized with Al, were studied with respect to the relationship of structure (especially grain size) to mechanical properties. Recommended applications for both coarse- and fine-grained steels.

3B-89. High-Duty Irons. *Automobile Engineer,* v. 39, Apr. 1949, p. 157-161.

Properties and production methods for meehanite irons made by a British firm.

3B-90. The Engineering Properties of Meehanite. A. Campion. *Foundry Trade Journal,* v. 86, Apr. 14, 1949, p. 335-338; Apr. 21, 1949, p. 369-372, 375.

Previously abstracted from *Engineer,* item 3B-58, 1949.

3B-91. Ductile Cast Iron. *Industrial and Engineering Chemistry,* v. 41, May 1949, p. 7A, 10A, 12A.

Development progress. By addition of Mg to molten cast iron, graphite is converted to a spheroidal or nodular form, which greatly improves strength, ductility, and elastic modulus. Through this development a low-cost foundry iron may become available which is easily produced and has excellent casting and physical properties, hitherto found only in cast steels.

3B-92. Vanadium Alloy Steels. T. W. Merrill. *Product Engineering,* v. 20, May 1949, p. 138-142.

Properties and applications of the principal types of V-containing steels, including forging steels, casting steels, spring steels, carburizing steels, and plate steels.

3B-93. Anomalous Behavior of the Dielectric Constant of a Ferromagnetic Ferrite at the Magnetic Curie Point. Frank G. Brockman, P. H. Dowling, and Walter G. Steneck. *Physical Review,* ser. 2, v. 75, May 1, 1949, p. 1440.

Effective dielectric constant, as a function of temperature, measured at 10,000 c.p.s. on a block of a commercial ferromagnetic ferrite provided with evaporated gold electrodes. It was found that the behavior of the dielectric constant at the magnetic Curie point can be described on the basis of straightforward electromagnetic theory.

3B-94. Report on Physical Properties Influenced by As-Quenched Hardness. *Society of Automotive Engineers,* Report MR-73, 42 pages.

Three steels, 1345, 13T45, and 4140, were investigated on the basis of their similar carbon contents, widely different hardenability, and the fact that the relatively high hardenability of the 13T45 steel was derived from special addition agents. Samples were quenched to Rockwell C-40, 47 and 55 and subsequently tempered to Rockwell C-35, for each grade. Microstructures representative of each heat treatment were studied in relation to physical test results.

3B-95. Some Aspects of the Effect of Metallurgical Structure on Fatigue Strength and Notch-Sensitivity of Steel. T. J. Dolan and C. S. Yen. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 664-689; discussion, p. 690-695.

Previously abstracted from advance reprint. See item 3B-44, 1949.

3B-96. Some Characteristics of Residual Stress Fields During Dynamic Stressing Above the Endurance Limit. James B. Duke. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 755-762; discussion, p. 763-766.

Previously abstracted from preprint. See item 24b-71, 1948.

3B-97. Changes Found on Reciprocated Steel, Chromium Plate, and Cast Iron Sliding Surfaces. J. N. Good and Douglas Godfrey. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 841-853; discussion, p. 854-856.

Changes in surface composition and surface characteristics were studied under run-in and wear conditions for forged steel rubbed against cast iron, chromium-plated cast iron rubbed against steel, and cast iron rubbed against cast iron. Use was made of specialized techniques in X-ray and electron diffraction, of chemical and metallographic analyses, and of hardness measurements. 24 ref.

3B-98. Eigenschaften von Rohguss mit 12% Mn (Hadfield-Stahlguss). [Properties of Pig-Iron Castings Containing 12% Mn (Hadfield-Cast Steel).] F. Roll. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 18-23.

Effect of the C-Mn ratio, and of Si and P. The steels were examined for hardness, appearance of fracture, microstructure, and high-temperature strength.

3B-99. Ueber magnetische Messungen an dauerbeanspruchten Stahlstäben. (Magnetic Measurements on Fatigue-Stressed Steel Bars.) Kurt Fink and Max Hempel. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 75-78.

Changes in magnetic induction on normalized and annealed solid bars of 0.4% carbon steel subjected to fatigue-bending stresses. 10 ref.

3B-100. On the Electrical Properties of Cold Worked Iron Carbon Alloys. A. B. Bhatia. *Proceedings of the Physical Society,* v. 62, sec. B, Apr. 1, 1949, p. 229-237.

Change on "aging" was investigated theoretically. During the process, the carbon atoms diffuse into the dislocations, thus forming rows of atoms. Electrical resistance due to scattering of electrons by these rows is expressed in terms of the scattering power of a single carbon atom dissolved in the iron lattice, and hence in terms of the resistance of the same number of randomly distributed carbon atoms. It is found that this change depends on the wavelength of the electrons at the Fermi surface. Using a value of about 0.6 electrons per atom for

iron, agreement with observed diminution in resistance is satisfactory.

3B-101. Effect of Sulphur on Quality and End Uses of Steel Products. M. Tenenbaum. *American Iron and Steel Institute,* Preprint, 1949, 39 pages.

Effects on tensile strength, hardness, ductility, impact resistance, hot workability cleanliness, machinability, grain size, grain-coarsening temperature, hardenability, weldability, and corrosion. Manner and degree to which sulfur influences the quality of various end products, data obtained by means of a questionnaire sent to 26 steel plants. 24 ref.

3B-102. Engineering Construction; Meeting High Performance Demands With Meehanite Metal. A. Campion. *Iron and Steel,* v. 22, Apr. 1949, p. 131-135; May 1949, p. 154-156.

Previously listed from condensed version under similar title: *Engineer,* item 3B-70, 1949.

3B-103. Mechanical Properties of Stainless Steels at Subzero Temperatures. John H. Hoke, Philip G. Mabus, and George N. Goller. *Metal Progress,* v. 55, May 1949, p. 643-648.

Ten of the more common stainless steels were tested down to —320° F. The austenitic grades have slightly higher Izod impact strength at low temperature than at 70° F. Ferritic and martensitic steels have low impact strength below 0° F. All grades show increased tensile strength at subzero temperatures, with more or less decrease in ductility.

3B-104. Selection and Heat Treatment of Forming Tools. Norman I. Stotz. *Metal Progress,* v. 55, May 1949, p. 652-657.

Principles as they relate to metal-forming tools, such as: plastic deforming tools (hot); die-casting and permanent-mold dies; forming and trimming dies; punches and chisels; and shear knives.

3B-105. The Sigma Phase in Stainless Steels. D. A. Oliver. *Metal Progress,* v. 55, May 1949, p. 665-667.

Attempts a restatement of the salient features of the sigma phase, supplemented by more recent results. Mechanical and magnetic properties and corrosion resistance vs. reheating temperatures for the 18-8 alloys, indicating influence of this phase.

3B-106. Composition and Property Variation of Two Steels. C. J. Osborn, A. F. Scotchbrook, R. D. Stout, and B. G. Johnston. *Welding Journal,* v. 28, May 1949, p. 227s-235s.

Progress Report No. 2 on the effect of fabrication processes on steels used in pressure vessels. Variation among heats of composition, structure, and properties of rimmed and aluminum-killed steels being used in the pressure-vessel research program at Lehigh University. Complete mill history. 10 ref.

3B-107. Nodular Graphite Cast Iron as an Engineering Material—A Correlated Review. *Materials & Methods,* v. 29, May 1949, p. 45-48.

Characteristics, possible applications, and method of production.

3C—Nonferrous

3C-78. Uber die Verwendung von Glas als Elektrolyt bei Messungen elektromotorischer Kräfte an Legierungen. (On the Use of Glass as an Electrolyte for Determining the Electromotive Forces of Alloys.) Oswald Kubaschewski and Otto Huchler. *Zeitschrift fur Elektrochemie und Angewandte Physikalische Chemie,* v. 52, Sept. 1948, p. 170-177.

The emf's of silver-gold alloys, with silver as the reference electrode, were determined between 300 and 600° C. The electrolyte was a Thuringian glass containing silver-ion. Objective of the experiments was to determine suitability of such glasses for this purpose. 29 ref.

3C-79. Anomalous Variations of Thermoelectromotive Force in the Magnetic Field of Ni-Mn Alloys. (In Russian.) R. G. Annaev. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Dec. 21, 1948, p. 639-640.

Variation of Thomson's transverse and longitudinal thermomagnetic effect with alloy composition. Charted data indicate that only pure nickel and its alloy with 5 atomic % Mn follow Akulov's second rule. In other cases Thomson's thermomagnetic effect has an anomalous character.

3C-80. Temperature Relationship of the Energy Constant to the Magnetic Anisotropy of Nickel. (In Russian.) L. V. Kirenskii. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 1, 1949, p. 53-56.

Investigated experimentally in the range from —183° C. to the Curie point, with emphasis on the range from 50° C. to this point. Method used.

3C-81. Surface Tension of Eutectic Alloys. (In Russian.) Yu. A. Kliachko and L. L. Kunin. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 1, 1949, p. 85-86.

The surface tension of a series of liquid binary metallic systems containing various percentages of Pb, Sn, and Bi was investigated experimentally, using specially developed test apparatus, at a temperature very near the crystallization point. Alloys corresponding exactly to the eutectic compositions were used. 14 ref.

3C-82. Unique Among the Elements. *Inco Magazine,* v. 23, Spring 1949, p. 4-6.

Properties and applications of 99.4% Ni.

3C-83. Vaporization of Titanium. L. G. Carpenter and Frank R. Reavell. *Nature,* v. 163, Apr. 2, 1949, p. 527.

The rate of evaporation of titanium wires in vacuo was measured from 1650 to 1800° K. Results are expressed mathematically. Variation of total radiation with temperature was also determined.

3C-84. High Density Alloy With Strength and Machinability Developed From Tungsten-Nickel-Copper Combination. G. H. Denny. *Steel,* v. 124, Apr. 18, 1949, p. 101-102.

Development; production by the powder-metal technique; and applications.

3C-85. Hardness of Certain Peritectic Alloys as a Function of Composition, Structure, and Temperature. (In Russian.) A. M. Korolkov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 114-123.

Results of investigation for three series of alloys: Sn-Sb (Sn: 60-100%); Zn-Ag (Zn: 75-100%); and Cd-Ag (Cd: 80-100%). Data show that the character of their hardness variation may be different despite the fact that their constitutional diagrams are identical. 14 ref.

3C-86. Heat Resistance of Certain Binary Copper Alloys. (In Russian.) M. V. Zakharov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 124-130.

The influence of degree of heterogeneity on relative heat resistance of a series of alloys of the Cu-Zn, Cu-Sn, Cu-Al, and Cu-Be systems. Phase diagrams, upon which are superimposed curves of hardness vs. composition at various temperatures.

3C-87. Problem of the Influence of Demagnetization of an Alternating Field on the Galvanoelastic Effect in Nickel. (In Russian.) V. I. Zaitsev. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, Jan. 1949, p. 95-110.

Results of investigation. Marked influence of demagnetization by an alternating field. The existence of "galvanoelastic" hysteresis was established. Methods of investigation.

3C-88. Influence of Nonstabilized Magnetic Structure on the Hysteresis of the Galvanomagnetic Effect in Nickel. (In Russian.) V. I. Zaitsev. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki* (Journal of Experimental and Theoretical Physics), v. 19, Jan. 1949, p. 101-104.

The possible cause of the anomalous shape of the hysteresis curve obtained by certain authors. Experimental method, test specimens used, and conditions of investigation. 11 ref.

3C-89. An Investigation of Creep, Fracture, and Bending of Lead and Lead Alloys for Cable Sheathing — Series 1946. Curtis W. Dollins. *University of Illinois, Engineering Experiment Station,* Bulletin Series No. 378, July 1, 1948, 90 pages. (*University of Illinois Bulletin,* v. 45, no. 65.)

Results of creep tests on strips and full sections of lead-cable sheathing. Lead alloys show considerable recovery during cyclic loading. Data are given which may account for the wide difference in the amount of creep obtained in laboratory tests and field tests. Stress-rupture tests in which loss of ductility as time for fracture is increased is very marked. Bending machines for testing the bending resistance of sheathing in strip form or extruded on cables. The marked superiority of the arsenical leads is shown by both strip and cable bend tests.

3C-90. Thermostat Metals. Unto U. Savolainen. "Engineering Laminates" (John Wiley & Sons, 1949), p. 351-381.

Properties of the various alloys used; methods of fabricaton; typical shapes; applications. 19 ref.

3C-91. Fatigue Properties of Some Coppers and Copper Alloys in Strip Form. H. L. Burghoff and A. I. Blank. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 709-732; discussion, p. 733-736.

Previously abstracted from preprint. See item 3c-37, 1948.

3C-92. The Effect of Small Percentages of Silver and Copper on the Creep Characteristics of Extruded Lead. G. R. Gohn and W. C. Ellis. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 801-814; discussion, p. 825-840.

Previously abstracted from preprint. See item 3c-30, 1948.

3C-93. Influence of Small Percentages of Silver on the Tensile Strength of Extruded Lead Sheathing. Howard S. Phelps, Frank Kahn, and William P. Magee. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 815-824; discussion, p. 825-840.

Previously abstracted from preprint. See item 3c-31, 1948.

3C-94. Specific Heats of Manganese and Bismuth at Liquid Hydrogen Temperatures. L. D. Armstrong and H. Grayson-Smith. *Canadian Journal of Research,* sec. A, v. 27, Mar. 1949, p. 9-16.

Reports measurements at 14-22° K. Results are compared with theory.

3C-95. The Tensile Strength of Titanium at Various Temperatures. R. L. Bickerdike and D. A. Sutcliffe. *Metallurgia*, v. 39, Apr. 1949, p. 303-304.

The literature and results of investigation. 16 ref.

3C-96. Calculation of Tensile Strength. *Metal Progress*, v. 55, May 1949, p. 690, 692, 694, 698, 700.

A critical summary of "Calculating the Tensile Strength of Metals and Its Dependence on Strain Rate and Temperature," Albert Kochendörfer, *Metallforschung* (previously abstracted from original item 3c-62, 1948). The reviewer indicates that the work does not bring us any nearer to theoretical understanding of the mechanical properties of metals and that the work is only a mathematical exercise based on doubtful assumptions.

3C-97. Ag-Mn Resistance Alloys. *Metal Progress*, v. 55, May 1949, p. 720.

Summarizes and critically discusses "Special Silver-Manganese Resistance Alloys," by Alfred Schulze, *Zeitschrift fur Metallkunde*, v. 34, 1942, p. 16-19. Binary Ag-Mn alloys with 9% Mn, annealed and slowly cooled, are said to have extremely desirable characteristics as resistance alloys for coils and shunts. The 8%-Mn, 7%-Sn alloy has a positive temperature coefficient of about 20 millionths at ordinary temperature, and no heat treatment under 200° C. changes it, while higher temperatures increase this factor slightly.

3D—Light Metals

3D-31. Recherches récentes sur les alliages Al-Zn-Mg-Cu. (Recent Research on Al-Zn-Mg-Cu Alloys.) A. Saulnier and G. Cabane. *Revue de Métallurgie*, v. 46, Jan. 1949, p. 13-23.

Newly developed French Al alloys having a very high elastic limit (up to 65 kg. per sq. mm.) and fatigue strength (16-18 kg. per sq mm.). Development of the 7.5% Zn, 2.5% Mg, and 7.5% Zn, 2.5% Mg, 1.5% Cu alloys. Chemical and physical properties including optimum conditions of heat treatment. 12 ref.

3D-32. Advances in Magnesium Technology. (Concluded.) *Canadian Metals and Metallurgical Industries*, v. 12, Apr. 1949, p. 30.

Properties of some new alloys.

3D-33. Beitrag zum Problem der Kaltaushärtung von Aluminiumlegierungen auf Grund dilatometrischer Messungen. (Research on the Cold Aging of Aluminum Alloys Utilizing Dilatometric Measurements.) Friedrich-Carl Althof. *Zeitschrift fur Metallkunde*, v. 40, Feb. 1949, p. 54-66.

Measurements made with Marten's reflector apparatus show that cold-aging alloys change in length by 0.003-0.02%. No correlation could be established between length changes and changes in strength. Dilatometric results are compared with those of X-ray analysis and critically evaluated. 28 ref.

3D-34. Combustion de l'aluminium dans l'oxygene. (Combustion of Aluminum in Oxygen.) Jean Cueilleron and Hubert Scartazzini. *Comptes Rendus*, v. 228, Feb. 7, 1949, p. 489-490.

Results of a spectroscopic study of the flame produced by combustion of aluminum powder in oxygen.

3D-35. Biaxial Fatigue Strength of 24S-T Aluminum Alloy. Joseph Marin and William Shelson. *National Advisory Committee for Aeronautics*, Technical Note No. 1889, May 1949, 41 pages.

The influence of various ratios of maximum values of principal stresses upon fatigue strength. Fluctuating biaxial tensile stresses were produced by applying a pulsating internal pressure and an axial tensile load to a thin-walled tubular specimen. Maximum and minimum values of the principal stresses were kept in phase. To apply the dynamic loads, a new type of testing machine was designed and constructed. S-N diagrams for four principal stress ratios were obtained for defining fatigue strength up to 5 x 10^6 cycles.

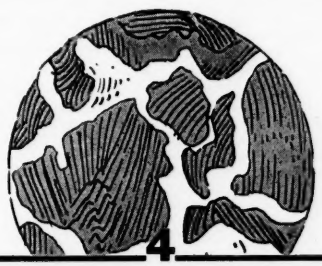
3D-36. Tensile, Creep and Fatigue Properties at Elevated Temperatures of Some Magnesium-Base Alloys. John C. McDonald. *American Society for Testing Materials, Proceedings*, v. 48, 1948, p. 737-753; discussion, p. 754.

Previously abstracted from advance reprint. See item 3D-18, 1949.

3D-37. New Aluminum Extruding Alloy Used for Tubing and Architectural Applications. *Materials & Methods*, v. 29, May 1949, p. 59.

Composition, properties, and applications of 63S alloy.

For additional annotations indexed in other sections, see:
4D-27; 9-138-143; 11-157; 19C-12



4 CONSTITUTION and STRUCTURE

4A—General

4A-41. The Liquidus Curve for Aluminum in Mercury. Herman A. Liebhafsky. *Journal of the American Chemical Society*, v. 71, Apr. 1949, p. 1468-1470.

The above curve was completed by making measurements designed to give good results with dilute Al amalgams. Diagram of apparatus.

4A-42. Theoretical Study of the Diffusion Constant for Self-Diffusion in Metals. M. Leichter. *National Advisory Committee for Aeronautics*, Technical Note No. 1856, Apr. 1949, 14 pages.

An expression is derived, based on the assumption that self-diffusion occurs by the vacancy mechanism. Important factors were found to be characteristic frequency of vibration of the atoms, crystal structure, lattice constant, heat of fusion, temperature, and activation energy for an atomic jump. Comparison of calculated values with the limited experimental data available shows that they are of the correct order of magnitude.

4A-43. On the Directional Character of the Long-Range Order Parameter. Louis Gold. *Physical Review*, ser. 2, v. 75, Apr. 15, 1949, p. 1265.

Points out that a significant aspect of the state of long-distance order in alloys, which apparently has been totally ignored, is the possible directional character of superlattice formation.

4A-44. Crystallite Theory of Strength of Metals. W. A. Wood and W. A. Rachinger. *Journal of the Institute of Metals*, v. 75, Mar. 1949, p. 571-594.

Evidence is presented for the belief that the metallic grain contains a fundamental unit of structure below which it cannot be broken down by plastic deformation at room temperature. The lower limiting size of the unit, termed "crystallite", has a characteristic value for a given metal. This size was determined for a group of body-centered cubic metals—Fe, Mo, Ta, and W—and ultimate tensile strengths were calculated on the basis of the above hypothesis. Measurement of crystallite size was accomplished by X-ray diffraction methods which utilize two recent developments to avoid complications of internal strains. 25 ref.

4A-45. Retrograde Solubility Curves Especially in Alloy Solid Solutions. J. L. Meijering. *Philips Research Reports*, v. 3, Aug. 1948, p. 281-302.

Using Gibbs' entropy of mixing and Richards' rule for the entropy of fusion of metals, a graph is derived thermodynamically, which serves to predict from eutectic concentration of the liquid and coexisting solid solubility at the eutectic temperature whether a solidus in a binary alloy system is retrograde or not. Agreement was found with solidus curves determined experimentally. Solidus curves in nonmetallic systems, transformation curves in iron alloys, and retrograde solubility in liquids. 37 ref.

4A-46. Kristalle und Kristallwachstum. (Crystals and Crystal Growth.) Dierick Kossel. "Physics of Solids" *(Office of Military Government for Germany)*, Part I, p. 15-42.

Reviews German contributions, 1939-46. 85 ref.

4A-47. Struktur der Metalle. (Structure of Metals.) Ulrich Dehlinger. "Physics of Solids" *(Office of Military Government for Germany)*, Part I, p. 77-83.

Reviews German contributions, 1939-46. 27 ref.

4A-48. Struktur Dunner Schichten. (Structure of Thin Films.) Heinz Raether. "Physics of Solids" *(Office of Military Government for Germany)*, Part I, p. 102-108.

Reviews German contributions, 1939-46. 22 ref.

4A-49. A Resonating-Valence-Bond Theory of Metals and Intermetallic Compounds. L. Pauling. *Proceedings of the Royal Society*, ser. A, v. 196, Apr. 7, 1949, p. 343-362.

The theory differs from older theory in making use of all nine stable outer orbitals of the transition metals, for occupancy by unshared electrons and for use in bond formation; the number of valency electrons is consequently considered to be much larger for these metals than has been hitherto accepted. It has been found possible to develop a system of metallic radii that permits detailed discussion of observed interatomic distances in terms of electronic structure. 15 ref.

4A-50. Electron-Atom Ratios in Alloy Phases as a Monotonic Sequence. A. J. Bradley. *Nature*, v. 163, Apr. 30, 1949, p. 683-684.

Examination of several systems indicates that there is a tendency for many alloy phases to occur when the ratio of the number of free valency electrons agrees with the monotonic sequence $(2n - 1)/n$ where $n = 1, 2, 3, 4, 5, 6, 7$.

4A-51. Internal Stresses in Worked Metals. G. B. Greenough. *Metal Treatment and Drop Forging*, v. 16, Spring, 1949, p. 58-64.

Lattice strains measured by X-ray techniques in plastically deformed metals. 15 ref.

4A-52. Anisotropic Plastic Flow. J. C. Fisher. *Transactions of the American Society of Mechanical Engineers,* v. 71, May 1949, p. 349-356.

Experimental data concerning the plastic flow of anisotropic polycrystalline aluminum indicate that predictions of the anisotropic-flow theory are in good agreement with experiment, and are significantly better than those of distortion-energy theory. Caution is indicated in interpreting the results of combined stress tests by means of the latter theory.

4B—Ferrous

4B-39. Effects of Various Deoxidizers on the Structures of Sulphide Inclusions. C. E. Sims, H. A. Saller, and F. W. Boulger. *American Foundrymen's Society,* Preprint 6, 1949, 15 pages.

Procedures followed and data obtained in a study of the effects of additions of 10 elements on inclusion characteristics. All of these elements have, or have been reputed to have, deoxidizing effects in steel.

4B-40. Note on As-Cast Structure and Grain Size in Cast Alloy Steels. Edward A. Loria. *American Foundrymen's Society,* Preprint 44, 1949, 8 pages.

New metallographic etching reagent for cast alloy steels shows as-cast austenite grain size in steels which do not show ferrite outlining of the original austenite grains. The number of as-cast grains in the central areas of etched cross sections for three steels were counted and average grain area compared with ASTM grain size developed at 1550 and 1700° F. It was found that there was no apparent relationship between the original and subsequent grain size.

4B-41. Grain Growth in Silicon-Chromium Valve Steel. H. Allsop and P. W. Bygate. *Journal of the Iron and Steel Institute,* v. 161, Apr. 1949, p. 318-325.

Severe grain growth occurs as a result of reheating critically strained material to sub-critical temperatures. The tendency to coarsen increases with increasing Si content, within the limits of B.S.En 52. The temperature necessary to effect refinement of coarsened material also increases with increasing Si and Cr. Effects of other factors.

4B-42. Mechanism of Solution of Carbides in Austenite. (In Russian.) V. I. Arkharov and S. T. Kiselev. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 136-137.

Investigated by means of X-ray analysis. Results formerly obtained on high-alloy steel are confirmed for low-alloy steel.

4B-43. Zum Mechanismus der γ/α-Umwandlung des Eisens. (The Mechanism of the γ/α Transformation of Iron.) Helmut Neerfeld and Karl Mathieu. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 69-73.

The phase transformations of iron wire studied under tensile stress. Results indicate that the transformation mechanism depends on the external test conditions and the resulting stress conditions. 12 ref.

4B-44. Deformation Phenomena on a Cleavage Facet of Iron. C. A. Zapffe and C. O. Worden. *Metal Progress,* v. 55, May 1949, p. 640-641.

During a detailed fractographic study of iron, progressive changes in cleavage pattern were observed as the metal was plastically deformed. Three fractographs.

4C—Nonferrous

4C-43. Der Einfluss des Silbers auf die Umwandlungen des Systems Gold-Kupfer. (The Effect of Silver on Transformations in the Gold-Copper System.) Ernst Raub. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 46-54.

Up to the saturation point of the ternary solid solution, silver greatly reduces the critical temperature of the AuCu transformation. The rate of transformation depends on the composition and state of the alloy as well as on its annealing temperature and previous mechanical treatment. Debye-Scherrer patterns.

4C-44. Mischkristallbildung in binären metallischen Legierungen. (Formation of Solid Solutions in Binary Metal Alloys.) Karl Löhberg. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 68-72.

The effect of the relative sizes of the different atoms; the importance of valence-electron concentration to the saturation concentration of the alpha solid solutions of several Cu and Ag alloys and to changes in the lattice dimensions of the alpha solid solutions of Mg and Zn alloys. 20 ref.

4C-45. Relation Between the Degree of Order and the Lattice Parameter of Cu_3Au. W. Betteridge. *Journal of the Institute of Metals,* v. 75, Mar. 1949, p. 559-570.

The lattice parameter was measured with the alloy in different degrees of short-distance order obtained by quenching from temperatures both above and below the critical temperature. The parameter is approximately linearly related to the degree of order. It is suggested that lattice parameters of solid solutions are better correlated with interatomic bond lengths than with atomic diameters, although bond lengths may vary with change in electron concentration. Parameters of the binary solid solutions of Cu, Ag, and Au were examined and bond lengths correlated with constitutional diagrams. 11 ref.

4C-46. The Primary Solid Solution of Silver in Aluminium. G. V. Raynor and D. W. Wakeman. *Philosophical Magazine,* ser. 7, v. 40, Apr. 1949, p. 404-417.

The solid solubility curve was redetermined, using pure materials. In contrast to the reports of previous workers, the solubility curve is not smooth, but exhibits a marked change in direction in the region of 49.4% Ag at 526° C. Maximum solid solubility is 55.6% Ag at the eutectic temperature of 566° C. It is shown that the change in direction of the solubility curve occurs at the same electron:atom ratio as the peak of the ($\alpha + \alpha_1$) miscibility gap in the Al-Zn system. Theoretical interpretation. 12 ref.

4C-47. The MBe_{13} Compounds. N. C. Baenziger and R. E. Rundle. *U. S. Atomic Energy Commission,* AECD-2506, Apr. 8, 1949, 4 pages.

A series of intermetallic compounds of composition MBe_{13} has been found, where M is U, Th, Ce, as Zr. Lattice constants and other structural parameters.

4C-48. A Calculation of the Solubility Limits of the Copper-Silver System. M. K. I. Arafa. *Proceedings of the Physical Society,* v. 62, sec. B, Apr. 1, 1949, p. 238-247.

Calculates change in the energy of a monovalent metal when one of its atoms is replaced by an atom of a different monovalent metal. From a knowledge of this energy, heat of solution can be determined and thereby, through the usual thermodynamic relations, solubility limits. Calculations show the existence of narrow solubility limits, in agreement with the known phase diagram. Theoretical values of heats of solution are compared with those required to give the observed solubility limits.

4C-49. Quasi-Chemical Theory of Order for the Copper Gold Alloy System. Yin-Yuan Li. *Journal of Chemical Physics,* v. 17, May 1949, p. 447-454.

Yang's general theory of superstructure is further generalized in terms of atomic distribution on sublattices of any number and of any geometrical arrangement. The possibility of the formation of different types of long-distance order due to the different recombinations of sublattices. The behavior of the Cu-Au system at very low temperatures and its phase diagram. Critical temperature, latent heat, curve of long-distance order, and energy vs. temperature for the CuAu tetragonal crystal. Results are quite different from those of Shockley's theory. 16 ref.

4D—Light Metals

4D-27. Uber die Beeinflussung der Erstarrungskristallisation von Magnesiumlegierungen durch Zirkonium und einige Eigenschaften von gegossenen Magnesium-Legierungen mit Zirkonium. (Influencing the Crystallization of Magnesium Alloys by Zirconium; Several Properties of Cast Zirconium-Containing Magnesium Alloys.) Franz Sauerwald. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 41-46.

Constitution diagram of Mg-Zr, the critical zirconium content, and the mechanism of grain refinement. The maximum grain refinement is obtained with 0.6% Zr, and Zr effects remarkable improvements in the properties of Mg alloys, especially in malleability, toughness, and corrosion resistance. Zr was found to have a similar effect on a series of polynary alloys of Mg.

4D-28. The Constitution of Aluminium-Copper-Magnesium Alloys. N. S. Brommelle and H. W. L. Phillips. *Journal of the Institute of Metals,* v. 75, Mar. 1949, p. 529-558.

Constitution of Al-rich portion of the above system was investigated over the range 0-40% Cu, 0-35% Mg by thermal analysis and microscopic examination. The occurrence of the two binary constituents, $CuAl_2$ and Mg_2Al_3, and of two ternary compounds, Al_2CuMg and Al_6CuMg_4, was confirmed. 39 ref.

4D-29. Observations on the Recrystallization Characteristics of Aluminium-Magnesium-Manganese Alloys. R. Chadwick and W. H. L. Hooper. *Journal of the Institute of Metals,* v. 75, Mar. 1949, p. 609-626.

Eleven binary and ternary alloys of commercial Al containing up to 1% Mg and 1.25% Mn were investigated, including effects of variations in cold working and annealing procedures.

For additional annotations indexed in other sections, see:

2B-130-140; 3B-105; 7C-22; 12-94

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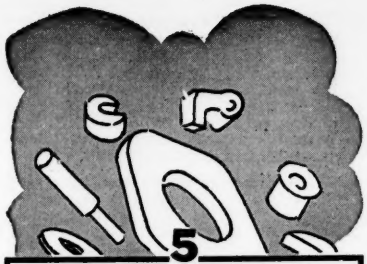


5 POWDER METALLURGY

5A—General

5A-28. Eine Methode zur Verdichtung komplizierter Metallpulverkörper. (A Method for Compressing Complex Metal-Powder Bodies.) Hermann Silbereisen. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 66-67.

A new automatic process suitable for the mass prodution of sintered parts.

5A-29. The Design Engineer Looks on Powder Metallurgy. Joseph L. Bonnano. *Electrical Manufacturing,* v. 43, May 1949, p. 103, 172, 174, 176.

Some design guideposts and selected case-histories that underscore the advantages of powder-metallurgy techniques. Toy-train parts are cited.

5A-30. The Design and Operation of Small Mills for Mixing Powder. D. Summers-Smith. *Metallurgia,* v. 39, Apr. 1949, p. 309-311.

Two sizes of ball mills designed to facilitate metallurgical research by powder-metallurgy methods. The larger is suitable for mixing samples of about 10 g. and the smaller for 1-g. samples.

5A-31. Dollars-and-Cents Advantages of Powder-Metal Parts. Joseph L. Bonanno. *Machine Design,* v. 21, May 1949, p. 133-136, 180, 182, 184.

Examples showing cost savings made possible by replacement of conventional by powdered-metal parts. Other advantages.

5B—Ferrous

5B-11. High Strength Parts Made From Prealloyed Steel Powders. *Steel,* v. 124, May 9, 1949, p. 114.

Method used for production of a complete series of prealloyed steel powders that can subsequently be heat treated to high hardness and strength levels. A small molten metal stream is disintegrated by water jets. The product is dewatered, furnace dried, and annealed.

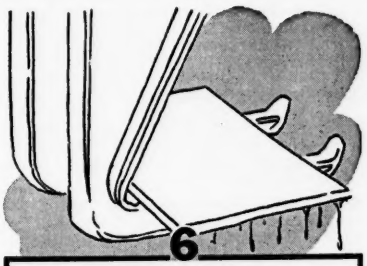
5B-12. Dauerfestigkeit von Sintereisen-Werkstoffen. (Fatigue Strength of Sintered-Iron Products.) M. Hempel and H. Wiemer. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 11-17.

Effects of powder composition and properties and of sintering pressure on fatigue and tensile strength. Methods of testing and results. 16 ref.

5C—Nonferrous

5C-10. Pure Platinum, of High Recrystallization Temperature, Produced by Powder Metallurgy. A. B. Middleton, L. B. Pfeil, and E. C. Rhodes. *Journal of the Institute of Metals,* v. 75, Mar. 1949, p. 595-608.

Previous work on powder metallurgy of Pt. Hitherto no essential difference has been noted between the physical properties of sintered and of melted and cast pure platinum. By sintering and hot working a fine powder compact, at a temperature considerably below its melting point, followed by severe cold drawing to wire, the fibrous structure of the wire is made to persist when heated at temperatures well above the recrystallization temperature of wire produced from melted, cast, and similarly worked material. The sintered wire also possesses greater resistance to elongation under tensile stress at high temperature and to intergranular corrosion than wire from melted and cast platinum recrystallized at the temperature of testing. 13 ref.



6 CORROSION

6A—General

6A-52. Intorno all'interpretazione del processo di corrosione per cavitazione. (Theory of the Stress-Corrosion Process.) Gernando Petracchi. *La Metallurgia Italiana,* v. 41, Jan.-Feb. 1949, p. 1-6.

Principal theories given in the literature. According to the author's theory, by the action of mechanical stresses, the corrosive effects of local microcells are produced or increased. Experimental results on ferrous and nonferrous metals show the importance of very weak currents used for cathodic protection or in anodic corrosion. 17 ref.

6A-53. Fatty Acids Versus Construction Materials. *Chemical Engineering,* v. 56, Apr. 1949, p. 217-218.

Part I of a symposium in which a representative group of construction materials is evaluated for services involving fatty acids. Includes: "Glass-Lined Steel", by S. W. McCann; "Carbon and Graphite", by W. W. Palmquist; and "Stainless Steel", by Grant L. Snair.

6A-54. Determination of Corrosion of Wire Test Specimens Under Constant Tensile Stress. (In Russian.) N. D. Tomashov and V. A. Titov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 48-53.

Specially developed apparatus for corrosion testing in synthetic brines. Typical test data on steel wire.

6A-55. Le rayonnement ultraviolet pendant l'oxydation anodique des métaux et des alliages. (Ultraviolet Radiation During Anodic Oxidation of Metals and Alloys.) R. Domansky. *Collection of Czechoslovak Chemical Communications,* v. 14, No. 1-2, 1949, p. 1-9.

Investigated on 14 different metals and on a series of alloys. Results indicate the presence of ultraviolet radiation during the anodic oxidation of Ta, Al, Si, Mg, Zn, and Cd and of alloys having these elements as base metals. Cu, Sn, Pb, Cr, Fe, Ni, Co, Pt, and their alloys did not show the above phenomenon.

6A-56. The Promotion and Acceleration of Metallic Corrosion by Micro-Organisms. T. Howard Rogers. *Engineer,* v. 187, Apr. 15, 1949, p. 424-425; discussion, p. 404.

A condensation.

6A-57. Crude Still Overhead System Corrosion. A. F. Blumer. *Corrosion,* v. 5, May 1949, p. 135-145; discussion, p. 146-147.

Various types of corrosion occurring in the above. Recommendations for combatting general corrosion by sulfide removal and neutralization of acidic constituents, as well as by proper selection of materials. Corrosion-test data obtained with a variety of metals in different locations. Dezincification, stress-corrosion, and corrosion fatigue. Effects of vibrations caused by machinery in operation. Conclusions.

6A-58. Station Design and Material Composition as Factors in Boiler Corrosion. R. B. Donworth. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 897-904; discussion, p. 905-906.

Previously abstracted from preprint. See item 6a-59, 1948.

6A-59. Zur Topochemie und Kinetik der Korrosionsvorgänge. (The Topochemistry and Kinetics of Corrosion Phenomena.) W. Machu. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 1-7.

Fundamentals of corrosion processes, showing that the most important factors of corrosion protection and rate of corrosion are stability and area of the cathode surface. A rule for change of cathode surface with time, according to which the rate of corrosion of a coated metal is always proportional to the effective cathode surface, not to the dissolving surface of the anode.

6A-60. Corrosion Resistance of Stainless, Monel and Nickel Castings. Norman S. Mott. *Materials & Methods,* v. 29, May 1949, p. 79, 81.

Resistance to common chemicals.

6B—Ferrous

6B-70. Uber die Potentialbildung von Eisen in gepufferter Essigsäure. (The Electrical Potential of Iron in Buffered Acetic Acid.) Richard Ergang. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 76-80.

Results of investigation of the effect of solution pH on potential and loss of weight in 1 and 8% solutions of air-containing and air-free sodium acetate.

6B-71. Sur la corrosion fissurante d'aciers doux a faibles teneurs en additions dans les nitrates. (Concerning Intercrystalline Corrosion of Low-Alloy Steels in Nitrate Solutions.) E. Herzog. *Métaux & Corrosion,* v. 24, Feb. 1949, p. 29-42; discussion, p. 42-44.

The above was investigated for steels containing 2.3% Cr and 0.8% Al as maximum amounts, in the form of castings, rolled sheets, and welds. Influence of heat treatment, cold working, and decarburization, and resulting crystalline structure. Mechanism of intercrystalline corrosion. 21 ref.

6B-72. Corrosion. Mars. G. Fontana. *Industrial and Engineering Chemistry,* v. 41, May 1949, p. 95A-96A.

Environment and corrosion testing of small pieces of equipment in the pilot plant.

6B-73. Internal Corrosion of Crude-Oil Tanks. R. A. Brannon. *World Oil,* v. 129, May 1949, p. 190, 192, 194, 200.

Protective coatings and their relative efficacies, and measures which should add greatly to tank life in such areas as West Texas.

6B-74. Effect of Various Aqueous Solutions Upon the Reactions at Pure Iron Anodes and Cathodes. Part II. (Concluded.) W. W. Kittelberger and

A. C. Elm. *Corrosion,* v. 5, May 1949, p. 155-167.

Experimental data for anodic reactions and for anodic passivity vs. current density in various aqueous solutions. Among the problems studied were: effects of variation in H-ion concentration; of variations in dissolved-O_2 concentration; and of chromate-ion concentration on behavior of pure-iron anodes.

6B-75. Corrosion in Sour Crude Storage Tanks. Derk Holsteyn. *Corrosion,* v. 5, May 1949, p. 168.

Corrosion before and after removal of some of the corrosion products. Gives analyses of products next to the steel and next to the space.

6B-76. Atmospheric Durability of Steels Containing Nickel and Copper—Additional Exposure Data. N. B. Pilling and W. A. Wesley. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 610-617.

Previously abstracted from preprint. See item 6b-68, 1948.

6B-77. Laboratory Corrosion Tests of Iron and Steel Pipes. G. A. Ellinger, L. J. Waldron, and S. B. Marzolf. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 618-627.

Previously abstracted from preprint. See item 6b-67, 1948.

6B-78. Factors of Importance in the Atmospheric Corrosion Testing of Low-Alloy Steels. H. R. Copson. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 591-607; discussion, p. 608-609.

Previously abstracted from preprint. See item 6b-66, 1948.

6B-79. Corrosion of High-Pressure Steam Generators: Status of Our Knowledge of the Effect of Copper and Iron Oxide Deposits in Steam Generating Tubes. Richard C. Corey. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 907-925; discussion, p. 926-939.

Critically reviews published information and attempts to correlate it with the author's experiences and available theoretical data. 30 ref.

6B-80. Investigation of Causes and Prevention of Closure of Oven Burner Ports. *American Gas Association Testing Laboratories,* Research Bulletin, 54, Feb. 1949, 19 pages.

Causes indicated by analysis of replies to a questionnaire sent to 28 gas companies and by results of a field trip in manufactured-gas territories. Exploratory studies were conducted at burner temperatures of 725-1500° F. Increased tendency toward port closure at increased temperatures. It was found that port closure may be reduced by treating the burner surface with a suitable protective coating, or by altering the composition by use of alloying elements.

6B-81. Hydrogen Overpotential and the Partial Inhibition of the Corrosion of Iron. J. O'M. Bockris and B. E. Conway. *Journal of Physical & Colloid Chemistry,* v. 53, Apr. 1949, p. 527-539.

Two main mechanisms of corrosion inhibition during pickling have been suggested. Experimental work done in order to determine the true mechanism involved. Results indicate that the inhibition is by means of a direct effect on the hydrogen activation overpotential and not by mechanical protection through an adsorbed film. 23 ref.

6B-82. Cathodic Protection Design Considerations. Raymond H. McLeod. *Journal, American Water Works Association,* v. 41, May 1949, p. 411-412.

Use to prevent corrosion on pipelines, tanks, etc. Design and cost factors.

6B-83. Requirements of Cathodic Protection Systems. Frank E. Dolson. *Journal, American Water Works Association,* v. 41, May 1949, p. 413-416.

For protecting steel in contact with soil or water.

6C—Nonferrous

6C-22. Prevention of Corrosion of Copper by Sulfur Compounds by Use of Anthraquinone. (In Russian.) L. G. Gindin and R. Kh. Sil's. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Dec. 21, 1948, p. 685-688.

Results of investigation established that certain hydrocarbons act as inhibitors in the process of copper corrosion by sulfur solutions. The best inhibitor was found to be 9,10-anthraquinone. Tests showed that 0.206% (by weight) of this substance protected a copper plate more than 200 days. It is believed that the corrosion inhibition is caused by adsorption of anthraquinone molecules by copper, thus preventing reaction with sulfur.

6C-23. The Mechanism of the Protection of Copper From Corrosion by Sulfur Solutions Using Anthraquinone. (In Russian.) Ya. I. Frenkel and L. G. Gindin. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 1, 1949, p. 91-93.

Attempts to explain theoretically the phenomenon of passivation of Cu discovered by the authors, using a benzene solution of sulfur containing 9,10-anthraquinone.

6C-24. Hastelloy Alloys. C. G. Chisholm. *Chemical Engineering,* v. 56, Apr. 1949, p. 218, 220.

Behavior when used in contact with various strengths of HCl and over a range of temperatures.

6C-25. Stress Corrosion in Naval Brass Weldments. Bela Ronay. *Welding Journal,* v. 28, Apr. 1949, p. 358-363.

The cause of cracks emanating from the ends of fillet welds which join the brackets to the inside of the shells of batteries of salt-water evaporators. Recommendations concerning fabrication of naval brass by arc welding using phosphor-bronze electrodes.

6C-26. Engine Bearing Failures. J. M. Stokely. *SAE Quarterly Transactions,* v. 3, Apr. 1949, p. 319-326.

Previously abstracted from condensed version in *SAE Journal;* item 6C-12, 1949.

6C-27. Mechanism of the Copper and Halogen-Ion Catalysis of Dissolution of Copper. Zoltan Szabo. *Journal of the American Chemical Society,* v. 71, Apr. 1949, p. 1511.

6C-28. Ein Beitrag zur Korrosion des Zinns. (Research on the Corrosion of Tin.) Ludwig Werner Haase. *Metalloberfläche,* v. 2, Aug. 1948, p. 166-168.

Presents result of experiments.

6C-29. Uber den Einfluss von Zusätzen auf die Oxydation von Nickel und Chrom-Nickel-Legierungen. (The Effect of Additions on the Oxidation of Nickel and Chromium-Nickel Alloys.) Lore Horn. *Zeitschrift fur Metallkunde,* v. 40, Feb. 1949, p. 73-76.

Incorporation of a second metal into pure Ni reduces its oxidation resistance. But in Cr-Ni alloys, a third metal accelerates the diffusion of the Cr atoms and thus causes the rapid formation of a protective Cr-oxide film. Explanation given is based on fundamental structural factors.

6C-30. Les réactions accélératrices de la corrosion du plomb dans le ciment. (Reactions Accelerating the Corrosion of Lead Imbedded in Cement.) M. Dodero. *Métaux & Corrosion,* v. 24, Feb. 1949, p. 50-56.

Results of investigations. Very weak direct or alternating currents, as well as the thermoelectric current induced by contact with certain metals, may accelerate the corrosive effect of cement, resulting in the formation of PbO. Strong electric currents may oxidize lead electrolytically, resulting in PbO_2.

6C-31. A Case of Corrosion Involving Cinders. C. H. Thompson. *Corrosion,* v. 5, May 1949, p. 151-154; discussion, p. 154.

Case of lead-cable corrosion at a point where the fill consisted of partly burned bituminous cinders. A gas main was adjacent, which resulted in setting up of an iron-carbon cell between the cinders and the gas main. Positive potentials thus generated caused the cable corrosion. It was necessary to remove the cinders completely, including scraping a 2-in. crust from the gas main; and to replace them with sand in order to remedy the condition.

6C-32. Preventing Corrosion in Relays. A. E. Herman. *Electrical Manufacturing,* v. 43, May 1949, p. 116-118.

In partially sealed, continuously operated relays, arcing at contacts may form nitric acid and ozone which attack metal parts and organic compounds. This type of corrosion was investigated experimentally. Results show need for ventilation of frequently operated relays to remove the corrosive atmosphere.

6C-33. Corrosion of Water Heaters by Flue Gases. Part 1. Effect of Temperature on the Corrosion of Tin-Lead Coatings. R. Kerr and Sonia M. Withers. *Journal of the Institute of Fuel,* v. 22, Apr. 1949, p. 204-208.

An apparatus in which the corrosion of solder-coated copper is determined under steady temperature conditions. Tests in which the composition of the flue gases is kept fairly constant, while the specimen temperature is varied from 38 to 125° C., using specimens coated with an alloy of 80% Pb and 20% Sn. Corrosion is at a maximum at the dew-point temperature of the flue gases, and at the temperature which would be the dew-point in the absence of SO_3.

6C-34. Effect of Non-Condensable Gases on Corrosion of Nickel in Steam Condensate. W. A. Wesley and H. R. Copson. *Journal of the Electrochemical Society,* v. 95, May 1949, p. 226-241.

Corrosive conditions of evaporator tubes on the steam side were simulated by tests in hot water saturated with mixtures of CO_2 and air under pressure. These showed that appreciable corrosion of nickel can occur from about 55-90% CO_2 by volume. In the presence of iron corrosion products, this range was broadened to about 40-90%. Corrosion can be prevented by removing air or CO_2 until their ratio is no longer critical. Inconel, tin, and stainless steel were resistant to attack under all experimental conditions. Zinc and some Cu alloys were also tested.

6D—Light Metals

6D-17. Der Einfluss des pH-Wertes und der Art der angreifenden Lösung auf die interkristalline und Spannungs-Korrosion bei Al-Mg-Legierungen. (Effect of pH-Value and Nature of Attacking Solution on Intercrystalline and Stress Corrosion of Al-Mg Alloys.) H. Vosskuhler. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 28-33.

Experimentally investigated with sea-water and similar solutions. Corrosion is inversely proportional to pH-value below 7; alkaline solu-

tions have no corrosive effect on these alloys.

6D-18. The Use of Inhibitors for Controlling Metal Corrosion. Part V. Inhibitors for Light Metals. G. T. Colegate. *Metallurgia,* v. 39, Apr. 1949, p. 316-318.
13 references.

For additional annotations indexed in other sections, see:
3B-82-105; 23C-36; 23D-40

7 CLEANING and FINISHING

7A—General

7A-55. Finishing Electric Clocks. Joseph St. Pierre. *Industrial Finishing,* v. 25, Apr. 1949, p. 30-32, 34.
Procedures applied to steel and diecast Al.

7A-56. Spark Guard for Electrostatics. S. M. Milanowski. *Electronics,* v. 22, May 1949, p. 138, 140, 142, 144.
Electronic safety device which has enabled manufacturers of electrostatic paint-spray equipment to comply with standards of the NBFU in producing high-voltage units that will not create a fire or safety hazard when utilized in a vapor-laden atmosphere.

7A-57. Barium Potassium Chromate Pigment in Metal Protective Paints. A. J. Eickhoff and L. M. Kebrich. *Paint, Oil and Chemical Review,* v. 112, Apr. 28, 1949, p. 18, 20, 39-42A.
Development, properties, and advantages. This pigment, now commercially available, is an efficient corrosion inhibitor of low tinting strength, which can be formulated into air-dry or baking-type coatings for metals. Recommended formulations. Test-panel photographs.

7A-58. Building Organic Protective Coatings to Special Requirements. K. G. Compton. *Corrosion,* v. 5, May 1949, p. 148-150.
The various types of organic coatings for metals. Examples of coatings formulated to fulfill special requirements, by application of scientific principles as well as empirical tests. 15 ref.

7A-59. A Method of Centrifuging Alkali Cleaners in Finishing Plants. Philip P. Sharples. *Finish,* v. 6, May 1949, p. 23-24, 68, 70.
Use of supercentrifuge to remove miscellaneous contaminants from metal-cleaning baths. Procedure resulted in load increase of 20% and large reduction in cleaner consumption.

7A-60. Some Thoughts on Drying. Rollin H. Wampler. *Products Finishing,* v. 13, May 1949, p. 46-50, 54, 56.
Mechanism of drying by evaporation of solvents, by oxidation and polymerization, and by polymerization alone. Some drying troubles and their solution.

7A-61. Spotlighting Finishing Progress. Allen G. Gray. *Products Finishing,* v. 13, May 1949, p. 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88.
Trends in alkyd resins; effect of copper in nickel-plating solutions on corrosion resistance of the plate; an accelerated atmospheric corrosion test for organic coatings; proper heating in galvanizing operations; and improved method for treatment of waste pickle liquor.

7A-62. Finishing of Metal Parts Speeded-up by Electro-Coating. Art Sheldon. *Production Engineering & Management* v. 23, May 1949, p. 57-59.
Conveyerized installation for electrostatic spraying of metal parts.

7A-63. Designing With Metallized Structures. John E. Wakefield. *Product Engineering,* v. 20, May 1949, p. 117-121.
Use of metallization to give specialized properties in local areas. Such properties include improved lubricating qualities, good resistance to wear and corrosion, low cost and improved electrical properties. Recommended surface preparation.

7A-64. Dielectric Continuity Tester. R. H. Marsh and Theodore Packard. *Electrical Manufacturing,* v. 43, May 1949, p. 119-120, 122.
By continuous testing of wire as it leaves the enamelling furnace, the pulse-timing unit checks insulation quality in process.

7A-65. Metallizing Non-Metallics. John Delmonte. *Modern Plastics,* v. 26, May 1949, p. 87, 90, 140.
Five methods are: chemical deposition of metallic films; adhesive films, metallic and graphitic powders; vacuum evaporation of metals; cathode sputtering; and metal spraying. Applications.

7A-66. Recent Developments in Metal Spraying. John E. Wakefield. *Modern Machine Shop,* v. 21, May 1949, p. 98-102, 104, 106.
Development and use of self-bonded metal, showing how this innovation opens up much wider applications of metal spraying, by eliminating need for extensive machining operations. Other new developments, including new metals for spraying, a gas-flow meter, metallizing guns. Greater wear resistance and ability to absorb lubricants are cited as properties of sprayed coatings.

7A-67. How to Finish Machines. R. E. Gwyther and E. S. Stout. *American Machinist,* v. 93, May 5, 1949, p. 90-93.
Recommended surface-preparation and paint application procedures for protection of machinery.

7A-68. Sprayed Metal. H. S. Ingham. "Engineering Laminates" (John Wiley & Sons, 1949) p. 551-572.
The equipment, the process, and the characteristics (including structure and corrosion resistance) of the product. Effects of base metal on bond strength for "Sprasteel" coatings. Applications.

7A-69. Surface Preparation. Prepara-tion of Metals for Organic Finishing. Walter R. Meyer. **Phosphate Treatments for Metals.** Walter A. Raymond. **Surface Prepcration as a Measure of Preventing Corrosion.** E. Davenport. **The Principles of Solvent Vapor Degreasing.** G. W. Walter. *Organic Finishing,* v. 10, Apr. 1949, p. 10-15, 17, 19-33.

7A-70. A Note on the Possible Role of the Solid Surface in Electroless Plating. E. E. Glenn, Jr., E. L. Cook, and Norman Hackerman. *Journal of the Electrochemical Society,* v. 95, May 1949, p. 110C-112C.
Some experiences with electroless plating of Ni on both glass and metal surfaces. Effects of seeding and rough surfaces on initiation of deposition. Theoretical conclusions.

7A-71. Evaluation of Surface Finish of Porcelain Enamels by a Replica

for Metal Cutting
for Lubrication
for Prevention of Rust

In place of animal fats and vegetable oils to save cost and provide stability in metal cutting lubricants, greases, and steam engine oils, etc.

In the preparation of preservative lubricants for the shipment of engines and replacement parts.

In the preparation of automotive, diesel and industrial oils of enhanced lubricity and detergency.

In the preparation of film-forming rust preventives, which will guarantee the safe arrival of overseas shipments of metal goods.

Write for samples and compounding instructions.

Write directly attention RESEARCH DIRECTOR

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3046 BUFFALO AVENUE
NIAGARA FALLS, NEW YORK

Method. J. C. Richmond and A. C. Francisco. *Journal of the American Ceramic Society,* v. 32, May 1, 1949, p. 170-179.

Technique for making ethyl cellulose replicas of enameled and other surfaces. Photographic prints of a number of replicas made without use of negatives, and methods of analyzing the replicas. Haze of replicas was used to evaluate 25 enamels abraded in the standard P.E.I. surface-abrasion test. Comparison of these ratings with those obtained by the standard method, visual estimates of abrasion as seen on the specimens, and as seen in the replicas. 14 ref.

7A-72. Metal Spraying. Miles J. Rowan. *American Machinist,* v. 93, May 19, 1949, p. 107-118.

Nature of sprayed metal and the conditions under which it may be expected to give good service. Equipment, and steps required to produce good coatings.

7B—Ferrous

7B-76. Corrosion-Proofing Simplified by Liquid Zinc-Content Coating Applied Like Paint. John R. Fisher, Jr. *Steel,* v. 124, Apr. 25, 1949, p. 80-82.

Coating, its advantages over other protective methods, its life expectancy, surface preparation, and undercoating.

7B-77. "10% Formula and 90% Application"—Key to Enameling Unusual Production Equipment Successfully. Herbert R. Spencer. *Ceramic Industry,* v. 52, May 1949, p. 56-59.

Procedures and miscellaneous pieces of industrial equipment enameled by Erie Enameling Co.

7B-78. The Trend Toward Lower-Firing Enamels. E. J. Kelly and G. E. Miller. *Enamelist,* v. 26, Spring 1949, p. 3-7.

Development of enamels for firing at 1350 and 1450° F.

7B-79. Facia Panel Manufacture. *Automobile Engineer,* v. 39, Apr. 1949, p. 164-166.

Procedures for bonding of wood veneer to steel by use of "Redux" liquid-resin adhesive, for automobile instrument panels or dashboards.

7B-80. Automatic Paint Booth and Drying Oven Speed the Finishing of Steel Barrels. *Industrial Heating,* v. 16, Apr. 1949, p. 667-668, 670, 672, 674, 676.

7B-81. Automatic Spraying; Metallic Protection of Constructional Steelwork. *Iron and Steel,* v. 22, Apr. 1949, p. 121-123.

Application of sprayed Al or Zn to structural steel and the new plant for cleaning and spraying the steel members—said to be the first of its kind in the world.

7B-82. Porcelain Enamel Murals in Architecture. Edward Winter. *American Ceramic Society Bulletin,* v. 28, Apr. 15, 1949, p. 162-163.

Properties and applications.

7B-83. Admiral Corp. Develops Tests for Enamel Spalling in Cold-Wall Refrigerators. *Ceramic Forum,* v. 16, Apr.-May 1949, p. 7, 9.

A recent innovation in refrigerators is simultaneous operation of a freezing unit and a nonfrosting preserving unit. Enameled surfaces subjected to this temperature gradient have a tendency to spall. Test apparatus which varies test-plate temperature from 28 to 36° F. 300-600 times per 24 hrs. Zirconia, antimony, and titania enamels were studied. The spalling tendency was found to be related to the existence of subsurface bubbles. An HF-etching test was developed which makes possible prediction of spalling characteristics.

7B-84. Evolution of an Enameling Plant for Electric Range Production. R. T. Goldthwaite. *Finish,* v. 6, May 1949, p. 19-22.

General information on fabrication, assembly, and handling methods.

7B-85. Simple Automatic Spraying Device. Herbert Chase. *Products Finishing,* v. 13, May 1949, p. 36, 38, 40.

Procedure for finishing bumper guards. They slide down a chute, moving gates that operate a spray gun through a micro switch and solenoid.

7B-86. Hot-Dipped Aluminum-Coated Steel. B. P. Finkbone. *"Engineering Laminates"* (John Wiley & Sons, 1949), p. 403-407.

Manufacture; subsequent fabrication; properties; and applications.

7B-87. Nickel-Clad, Monel-Clad, and Inconel-Clad Steel. W. G. Theisinger. *"Engineering Laminates"* (John Wiley & Sons, 1949), p. 426-452.

Processes of manufacture, subsequent fabrication operations, mechanical properties, design of clad-steel equipment. Data on resistance of Monel, nickel, and Inconel to corrosion by common industrial chemicals. Applications.

7B-88. Stainless Clad Steel. Charles A. Scharschu. *"Engineering Laminates"* (John Wiley & Sons, 1949), p. 453-462.

The various methods (casting, fusion melting, intermelting, and hot rolling); corrosion resistance, mechanical properties, and applications. 111 ref.

7B-89. An Investigation of the Possibilities of Organic Coatings for the Prevention of Premature Corrosion-Fatigue Failures in Steel. Robert C. McMaster. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 628-644; discussion, p. 645-647.

Previously abstracted from advance reprint. See item 7B-53, 1949.

7B-90. Die Phosphatierung als topochemische Reaktion. (Phosphating as a Topochemical Reaction.) A. Wustefeld. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 43-45.

Effect of accelerators, the properties of the phosphate film (surface structure, color, plasticity), its effect on the hardenability of lacquer, and its adsorbing power for lubricants.

7B-91. Hot-Dip Galvanizing; A Practical Technique for Hydrochloric Acid Pickel Control. Thomas B. Crow. *Metallurgia,* v. 39, Apr. 1949, p. 298-302.

Development of a method for control of pickling operations preliminary to galvanizing. The technique, although primarily for the treatment of steel window frames, is generally applicable in the ferrous industry.

7B-92. Trouble Shootin'. John L. McLaughlin. *Better Enameling,* v. 20, May 1949, p. 36-37.

Defects and practical remedies: pitting; black edge tearing—alligator; rippling; hard and soft bisque; beading along flanges; cracking; scars; and dusting.

7C—Nonferrous

7C-22. The Growth and Structure of Thin Metallic Films. Henry Levinstein. *Journal of Applied Physics,* v. 20, Apr. 1949, p. 306-315.

Combines electron microscopy and electron diffraction in a systematic survey of thin metallic films and some factors affecting their structure. 16 ref.

7C-23. Polishing and Plating Swing Spout Faucets. Fred M. Burt. *Products Finishing,* v. 13, May 1949, p. 22-24, 26, 28, 30, 32.

Production procedure. Parts are made from brass, then sanded, buffed, polished, cleaned, and chromium plated, followed by final assembly, rigid testing and inspection, polishing, and packaging.

7C-24. Copper and Copper-Alloy Clads. W. L. Keene. "Engineering Laminates" (John Wiley & Sons, 1949), p. 408-425.

Historical development, methods of manufacture (casting, pressing, rolling), and miscellaneous properties, including corrosion resistance.

7C-25. The Exchange of Ag^+ Ions Between Aqueous Solutions and Surfaces of Metallic Silver. C. C. Coffin and I. I. Tingley. *Journal of Chemical Physics,* v. 17, May 1949, p. 502-503.

Results of a study made with the use of a radioisotope of silver.

7D—Light Metals

7D-20. Production-Line Processing of Aluminum for Painting. Arthur P. Schulze. *Industrial Finishing,* v. 25, Apr. 1949, p. 37-38, 40.

Simple cleaning and corrosion-proofing treatment used on aluminum castings for outboard motors.

7D-21. Modified Surface Treatment for Magnesium. *Iron Age,* v. 163, Apr. 28, 1948, p. 77. Based on report by L. Whitby, *Metallurgia,* Mar. 1949.

Appropriate additions of sodium dichromate to selenious acid baths provide a surface treatment for magnesium that compares favorably with standard chromate and seleium coatings from the standpoints of both salt-spray resistance and effectiveness as a paint base.

7D-22. Aluminum-Clad Products. E. H. Dix, Jr. "Engineering Laminates" (John Wiley & Sons, 1949), p. 382-402.

Core and coating compositions of the "Alclads"; method of bonding (hot rolling); corrosion resistance; thermal treatments; and mechanical properties. Briefly mentions "Magclad" sheet. 26 ref.

7D-23. Surface Finishing of Aluminium. I. Cladding, Spraying and Anodic Treatment. D. H. Napier and J. V. Westwood. *Chemical Age,* v. 60, Apr. 2, 1949, p. 488-490.

A review. 15 ref. (To be continued.)

7D-24. Cleaning Aluminum Sheet Prior to Spot Welding. Gerard H. Boss. *Metal Progress,* v. 55, Apr. 1949, p. 499-503, 522, 524; May 1949, p. 668-673.

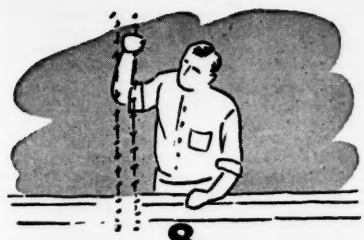
Part I correlates available information on methods. Method and apparatus for measuring the electrical resistance of the surface film. Part II deals with degreasers; room-temperature deoxidizers; commercial cleaning practices; influence of prior heat treatment; effect of final rinse water; and miscellaneous observations.

7D-25. Chemical Surface Treatments for Metals. Part Two. A. E. Durkin. *Tool Engineer,* v. 22, May 1949, p. 34-36.

For Al and Mg. Comparative corrosion resistances of samples after salt-spray testing.

7D-26. Deposition of Metals on Aluminum by Immersion From Solutions Containing Fluorides. Samuel Heiman. *Journal of the Electrochemical Society,* v. 95, May 1949, p. 205-225.

New process for depositing Zn, Cd, and Sn by chemical displacement upon Al. Immersion solutions contain the metal sulfate and either HF or the fluoride anion. The deposited metals have good appearance, sound structure, and excellent adhesion. The Zn-Al bond is the best and is greater than the cohesive strength of the base metal. 58 ref.



8

ELECTRODEPOSITION and ELECTROFINISHING

8-100. Die Rolle der Inhibitoren und der Katalysatorgifte bei der elektrolytischen Abscheidung von Wasserstoff und der elektrolytischen Reduktion. (The Role of Inhibitors and Catalyst Poisons in the Electrolytic Evolution of Hydrogen and in Electrolytic Reduction.) Hellmut Fischer. *Zeitschrift fur Elektrochemie und Angewandte Physikalische Chemie,* v. 52, May 1948, p. 111-133.

Critically discusses the above in connection with the cathodic separation and deposition of metals. Tables and graphs of data in the literature.

8-101. Uber periodische chemische Reaktionen. V. Das anodische Verhalten von Kupfer in Salzsaure. (Periodic Chemical Reactions. V. The Anodic Behavior of Copper in Hydrochloric Acid.) K. F. Bonhoeffer and Heinz Gerischer. *Zeitschrift fur Elektrochemie und Angewandte Physikalische Chemie,* v. 52. Sept. 1948, p. 149-160.

Results of extensive experimental study. Effects of numerous factors, apparatus.

8-102. Obtention de formes géométriques précises par polissage électrolytique. (Production of Precise Geometrical Forms by Electropolishing.) Pierre Michel. *Revue de Métallurgie,* v. 46. Jan. 1949, p. 39-44; discussion, p. 45.

Electropolishing to a tolerance of only a few microns appeared to be technically, but not economically, feasible. The process might be feasible if conducted with the more modern equipment.

8-103. Methods for Electroplating Metals on Nonconducting Materials. *National Bureau of Standards,* Letter Circular LC936, Jan. 14, 1949, 4 pages.

Details of the various methods may require modification for specific products.

8-104. Statistical Quality Control and the Electro-Deposition Process. G. F. Mortimer Young. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 229-237, 239-242.

System which covers all operations from start to finish of the process.

8-105. Control of Electroplating Solutions by Analysis and Observation. VIII. The Control of Nickel Plating Solutions. K. E. Langford. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 245-248.

8-106. Black Nickel Plating: Solutions, Defects and Remedies. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 249-252.

Defects, probable causes, and suggested remedies. Recommended solution recipes.

8-107. Electrolytic Polishing of Nickel: Recent American Developments Reviewed. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 253-256.

Phosphoric-sulfuric and phosphoric-chromic acid baths and procedures.

8-108. Recent Developments in Low Tension Power Supply. D. Ashby. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 273-283; discussion, p. 283-285.

Evolution of the modern low-voltage rectifier and important new developments in automatic control of plating operations.

8-109. Nickel Plating for Industry. *Canadian Metals and Metallurgical Industries,* v. 12, Apr. 1949, p. 20-21, 42.

Ni plating of miscellaneous industrial equipment. Advantages and examples.

8-110. Separating Films; A Key to Successful Electroforming. E. Mehl. *Metal Industry,* v. 74, Apr. 8, 1949, p. 268-269.

Requirements, types, and methods of applications of separating films required to facilitate removal of electro-formed articles from the mold, matrix, mandrel, or master. 12 ref.

8-111. The Electrolytic Polishing of Metals in Research and Industry. D. S. Kemsley and W. J. McG. Tegart. *Div. of Tribophysics, Council for Scientific and Industrial Research, Commonwealth of Australia,* Physical Metallurgy Report No. 7, 1948, 66 pages. (Serial No. A160.)

Mechanism; metallographic and research applications; and industrial methods and applications. 60 ref.

8-112. Die Herstellung von hartverchromten Gleitflächen mit guten Laufeigenschaften. (The Production of Hard-Chromium Plated Bearing Surfaces With Good Sliding Properties.) Karl Gebauer. *Metalloberfläche,* v. 2, Aug. 1948, p. 161-165.

The problem of lubricating chromium-plated sliding surfaces and methods of producing "oil-pockets" as a means of counteracting the poor wettability of chromium with oil. Structures of surface layers and bond to the base metal.

8-113. Special Light Alloys for Electro-Polishing. J. Hérenguel and R. Segond. *Engineers' Digest,* v. 10, Jan. 1949, p. 27-28. Translated and condensed from *Revue de l'Aluminium,* v. 25, Oct. 1948, p. 306-310.

Previously abstracted from the original, item 8-260, 1948.

8-114. L'Aluminium et ses alliages corroyés de qualité spéciale pour le polissage électrolytique et l'oxydation anodique. (Aluminum and Its Cold-Worked Alloys of Special Quality for Electropolishing and Anodic Oxidation.) J. Hérenguel and R. Segond. *Métaux & Corrosion,* v. 24, Feb. 1949, p. 45-49.

Need for improvement of the quality of Al and its alloys in order to improve the quality of electropolished and anodized products. Suggests that this can be done by investigating the effects of changes in heat treatment and cold working procedures on the quality of the finished products.

8-115. The Role of Natural Convection in Electrolytic Processes. Carl Wagner. *Journal of the Electrochemical Society,* v. 95, Apr. 1949, p. 161-173.

It is shown theoretically and experimentally that a well-defined convective flow due to the generally smaller density in the boundary layer and the resulting buoyancy exists at a vertical electrode. Interplay between diffusion and convective flow determines the limiting current density which occurs if such a voltage is applied that the concentration of one of the reactants at the electrode drops to zero. 11 ref.

8-116. Physical Properties of Iron Deposited From Chloride Baths. I. Larson, R. W. Moulton, and G. L. Putnam. *Journal of the Electrochemical Society,* v. 95, Apr. 1949, p. 86C-91C; discussion, p. 91C-92C.

Determination was made of the effects of pH, temperature, current density, and ferric-iron concentration. 15 ref.

8-117. Electro-Tinning Steel Strip; Expenditure of Electrical Energy. John H. Mort. *Iron and Steel,* v. 22, Apr. 1949, p. 112-116.

Develops calculation procedures. Typical applications. Consideration of the secondary process for conversion of the matte surface formed in the plating tank to a bright finish. This is done by raising the temperature to just above the melting point of the tin, followed by quenching and immersion in dilute chromic acid.

8-118. Production of Air-Cooled Copper Heads—for Bristol Sleeve-Valve Engines. Part II. Nickel-Plating of Copper Base; Assembly of Units; Centrifugal Brazing; Electrical Adhesion-Test. *Aircraft Production,* v. 11, May 1949, p. 168-171.

8-119. Barrel Gold Plating. Edward A. Parker. *Plating,* v. 36, May 1949, p. 448-451, 516.

Details of use of a solution of controlled low-gold, high free-cyanide content in barrel plating of jewelry and other decorative items. Uniformity of finish produced together with ease of control and low cost. It also serves as an excellent strike solution prior to heavy gold plating in barrels. Some work has been done on decorative and acid-resisting gold alloys, in particular pale yellow deposits, with the same general type of solution.

8-120. Manufacturing Electroplated Bearings. *Plating,* v. 36, May 1949, p. 452-455.

Equipment and forming, machine-shop, and inspection procedures.

8-121. The Practical Significance of Good Power Transmission. L. C. Borchert and R. B. Kinnaman. *Plating,* v. 36, May 1949, p. 456-461.

As applied to electroplating. Some of the defects noted if stray currents are allowed to exist, how to detect them and how plating systems can be engineered to prevent them, and means for their elimination.

8-122. Die Elektroplattierung nichtrostender Stähle. (Electroplating Stainless Steels.) R. Weiner. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 38-42.

Principles and different method of silver and gold plating stainless steels.

8-123. The Purification of Plating Solutions. G. T. Colegate. *Electroplating and Metal Finishing,* v. 2, Apr. 1949, p. 221-223.

Methods of removal of the usual contaminants from the usual plating solutions. (To be continued.)

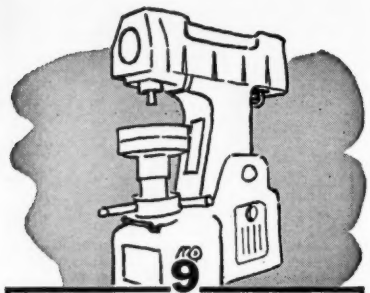
8-124. Adhesion Strength of Electrolytic Deposits. R. Erdmann. *Engineers' Digest,* v. 10, Apr. 1949, p. 116-117. Translated and condensed from *Metalloberfläche,* v. 2, May-June 1948, p. 117-119.

Factors affecting it.

8-125. Bright Nickel Plating Provides Low Cost Quality Finish. Jerome L. Bleiweis. *Materials & Methods,* v. 29, May 1949, p. 52-55.

Economical finishes and decorative effects otherwise unattainable are produced by bright nickel plating on various ferrous and nonferrous metals. Recommended cycles.

For additional annotations indexed in other sections, see: 7C-23



9 PHYSICAL and MECHANICAL TESTING

9-119. Some Experiments on a Bearing and Wear-Testing Machine. A. Cameron. *Journal of the Institute of Petroleum,* v. 35, Feb. 1949, p. 126-131.

Modifications of a Timken wear-testing machine made to illustrate the principles of film lubrication. Actual frictional drag, measured friction coefficient, and frictional drag and time during running in.

9-120. Influence de la forme et des dimensions de l'éprouvette sur la limite de fatigue. (Influence of the Shape and Size of the Sample on the Fatigue Limit.) Pierre Laurent. *Revue de Métallurgie,* v. 46, Jan. 1949, p. 55-59; discussion, p. 59.

Attempts to explain the facts that in fatigue testing, fracture occurs at stresses lower than the elastic limit, that resistance to fatigue does not follow Kick's law (fatigue strength decreases with increase of the size of the test specimen), and that the surface condition is much more important than in other mechanical tests. 14 ref.

9-121. Stress Analysis for the Steel Foundry. Robert G. Waite. *Foundry,* v. 77, May 1949, p. 106-107, 252, 254.

The nature and magnitude of residual stresses induced by welding plates in openings in castings.

9-122. Determining Stresses in 110-Ton Gooseneck Trailer by Strain Gage Method. Given Brewer. *Automotive Industries,* v. 100, May 1, 1949, p. 42-44, 74.

Describes and diagrams methods. Load vs. strain curves for various gage locations.

9-123. New Methods of High-Temperature Mechanical Testing. (In Russian.) A. M. Borzdyka. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 70-75.

Methods used for testing at a controlled rate of elongation, for creep testing at 800-1200° C.; for creep testing during bending; and for testing by a relaxation method. 11 ref.

9-124. Centrifugal Method for Investigating Strength of Metals and Alloys at High Temperatures. (In Russian.) I. I. Kornilov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 76-82.

A new type of apparatus particularly applicable for determination of the bending strength of a material in the range from room temperature up to 1200° C. Conditions of testing using such a method are very close to those of practical application.

9-125. Fatigue-Testing Machine for Use at High-Temperatures. (In Russian.) N. I. Mikheev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 82-85.

A special machine deveioped. Size and shape of test specimens. Maximum temperature of testing is 900° C.; maximum stress is 60 kg. per sq. mm.; accuracy of temperature control is ±2° C.

9-126. Machine for Fatigue Testing a Stationary Test Specimen at Elevated Temperatures. (In Russian.) S. I. Yatskevich. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 86-88.

New type of apparatus. Maximum stress obtainable is 50 kg. per sq. mm. Circuit diagram of the heating chamber.

9-127. Fatigue-Testing Machine for Horizontal Bending. (In Russian.) A. N. Mitinskii and V. A. Bykov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 89-91.

Structural details of the machine and shape and size of test specimens used. Simplicity of construction and possibility of investigating relatively large test specimens.

9-128. Determination of Coefficient of Sliding Friction. (In Russian.) I. A. Savostin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 96-99.

A specially constructed machine for the above. Theoretical bases of this method of testing.

9-129. Application of Pulsating Device for Testing Transmission-Gear Teeth Using a Large Model. (In Russian.) R. S. Nikolaev, E. F. Mikhenko, and L. M. Shkol'nik. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 124-125.

Device and how it is used.

9-130. Mechanical Testing of Welded Joints. (In Russian.) F. I. Razdui. *Avtogennoe Delo* (Welding), Jan. 1949, p. 21-22.

Standard tensile and bending tests according to the All-Union Standard, including the size of test specimens for different types of welding.

9-131. Theory of Hardness and Measurements Applicable to Contact Problems. Else Holm, Ragnar Holm, and Erle I. Shobert, II. *Journal of Applied Physics,* v. 20, Apr. 1949, p. 319-327.

The ball indentation method is recommended for the determination of real contact area. Hardness is defined as the ratio between the contact load and the mouth area of indentation. Variation of hardness with geometric and metallurgical conditions and the relation between hardness and yield point. 10 ref.

9-132. Testing Tractor Gears. *SAE Journal,* v. 57, May 1949, p. 38-40. Based on "Gear Testing Methods for the Development of Heavy-Duty Gearing" by R. P. Van Zandt and B. W. Kelley.

9-133. Fatigue and Static Load Tests of an Austenitic Cast Iron at Elevated Temperatures. W. Leighton Collins. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 696-705; discussion, p. 706-708.

Previously abstracted from Advance Reprint. See item 9-90, 1949.

9-134. An Hypothesis for the Determination of Cumulative Damage in Fatigue. F. E. Richart, Jr., and N. M. Newmark. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 767-798; discussion, p. 799-800.

Previously abstracted from advance reprint. See item 9-91, 1949.

9-135. Testing Speed Limitations for Committee A-1 Specifications for Steel. Lawford H. Fry. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 1130-1132.

Previously abstracted from preprint. See item 9b-32, 1948.

9-136. The Effect of Speed of Testing on Magnesium-Base Alloys. A. A. Moore. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 1133-1138.

Results of an extensive series of tension and compression tests at various speeds. Different means of specifying speed of testing.

9-137. Methods and Equipment for Controlling Speed of Testing. Lawrence K. Hyde. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 1191-1199; discussion, p. 1200.

Device for controlling rate of application of load or rate of travel of the crosshead so as to obtain a predetermined uniform rate of straining throughout the elastic range and as far as desired into the plastic range. Also a simple time-interval marking device.

9-138. Flexural Fatigue Strength of Steel Beams. Wilbur M. Wilson. *University of Illinois, Engineering Experiment Station,* Bulletin Series No. 377, Jan. 22, 1948, 34 pages. *(University of Illinois Bulletin,* v. 45, no. 33.)

Previously abstracted from *Welding Journal,* item 9b-47, 1948.

9-139. Das Verhalten dunner Querschnitte bei Schlagbeanspruchung und tiefer Temperatur (Kerbschlagversuche). [The Behavior of Thin Metals Under Impact Stress and at Low Temperatures (Notch-Impact Tests).] Anton Pomp and Alfred Krisch. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 19-25.

To develop small standard impact bars, comparative impact tests were made with standard bars and with bars measuring 6 x 3 x 55, 6 x 3 x 45, and 4 x 3 x 27 mm. provided with V, key-hole, and round notches. The thin specimens were found to have less temperature sensitivity from −80 to +150° C. Additional tests determined the effect of sample width on temperature sensitivity of alloyed and unalloyed steels between 20 and −183° C. 29 ref.

9-140. Beitrag zur Entwicklung einer kleinen Kerbschlagprobe. (Developing a Small Notch-Impact Bar.) Nikolaus Ludwig. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 27-29.

Notch-impact strength of 6 x 6 x 44 mm. bars was determined from −80 to 200° C. Results are compared with those obtained with the standard bar.

9-141. Das Verhältnis der Kerbschlagzähigkeit bei Verwendung verschiedener Probenformen. (The Relationship of the Notch-Impact Strengths of Different Shapes of Test Specimens.) Carl Bihlmaier. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 31-35.

Notch-impact values of different forms and corresponding conversion.

9-142. Einfluss der Kerbform und Bearbeitung auf die Schlagzähigkeit von Stahl in der Kälte. (Effect of Notch Form and Surface Condition on the Impact Strength of Steel at Reduced Temperatures.) Walter Reinecken. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 37-39.

Investigated for five different steels at temperatures from 20 to −40° C. Yield point, tensile strength, elongation, and contraction of area of each steel at the various temperatures.

9-143. The Relaxation Test in Terms of Creep and Creep Recovery. E. A. Johnson. *Metallurgia,* v. 39, Apr. 1949, p. 291-297.

An effort to ascertain the relative importance of creep recovery as a link between the relaxation test and normal creep tests. Relaxation tests from relatively high and relatively low initial total strains were made on a 0.17%-C steel at 445° C., and on a Cr-Mo steel at 485° C. Estimates of creep recovery during the relaxation test were made by com-

pletely unloading the specimen at intervals during the test. Adjustment of measured creep rates was made to allow for effects of negative recovery strain; and modified relaxation-creep rates were compared with rates computed from auxiliary creep tests.

9-144. Mechanical Testing of Cast Iron. A. Portevin. *Metal Progress,* v. 55, May 1949, p. 657-658.

Relationship of mechanical properties to composition and ultimate use; relation between mechanical properties of the casting itself and results of tests made on separately cast specimens; and reproducibility of results of a given test.

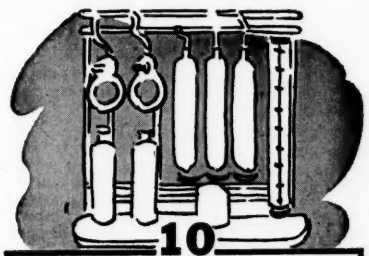
9-145. Stress Analysis of a Hortonsphere. L. P. Zick and C. E. Carlson. *Welding Journal,* v. 28, May 1949, p. 205s-214s.

Strain-gage survey around the supports of a 48-ft. diam. Hortonsphere. Present design-stress allowances proved adequate.

9-146. Variable Stroke Fatigue Mechanism. *Machine Design,* v. 21, May 1949, p. 144-145.

Machine designed for study of full-sized machines and structural parts normally subjected to low-frequency vibrations or stress variations. It is capable of loading a part 5 x 5 x 5 ft. to 10,000 lb. in tension or compression at 250 cycles per min. Stroke can be varied from 0-8 in.

For additional annotations indexed in other sections, see:
3A-109; 5B-12



10 ANALYSIS

10A—General

10A-59. Electrocapillary Curve of Mercury in the Presence of Polyvalent Cations. (In Russian.) L. M. Shtifman. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 63, Dec. 21, 1948, p. 709-712.

Data on behavior of the dropping mercury electrode in $AlCl_3$ and $ThCl_4$ and in mixtures of monovalent metal chlorides with them.

10A-60. Note sur l'or dans les minerais de fer. Précautions a prendre pour en déceler la présence. (Note Concerning Gold in Iron Minerals. Precautions Necessary to Detect Its Presence.) A. Riester. *Revue de Métallurgie,* v. 46, Jan. 1949, p. 36-38.

Qualitative procedures. Gold and silver have both been found in economic amounts in various iron ores from the French colonies in Africa.

10A-61. Micro Analysis of Gases Evolved From Metals. Gerald W. Keilholtz and Martha J. Bergin. *Instruments,* v. 22, Apr. 1949, p. 320-321, 360-361.

Apparatus and procedure.

10A-62. Multipurpose Electroanalytical Servo Instrument. James J. Lingane. *Analytical Chemistry,* v. 21, Apr. 1949, p. 497-499.

Instrument provides a variety of automatic services in the electroanalytical laboratory. Its chief components are commercially available units. Various applications, including methods based on electrolysis at controlled potential, constant total applied e.m.f., or constant current, and automatic potentiometric titrations.

10A-63. A Guide to Colorimetric Methods of Analysis. Louis Silverman. *Iron Age,* v. 163, Apr. 28, 1948, p. 88-90, 138, 140, 142, 144, 146, 148, 150-153, 169.

Practical colorimetric methods for the metallurgical analytical laboratory. Tabulates the elements in the various ferrous and nonferrous alloys which can be determined colorimetrically. Those which are best determined colorimetrically, taking into consideration time involved and other factors.

10A-64. A Spectrophotometric Method for the Determination of Aluminum in the Presence of Iron Using Ferron. W. H. Davenport, Jr. *U. S. Atomic Energy Commission,* AECD-2220, July 6, 1948, 5 pages.

Method is suitable for accurate determination of 0-50 μg of Al in the presence of 0-100 μg of Fe.

10A-65. A Review of Infra-Red Spectroscopy in Analytical Chemistry. (In English.) F. R. Cropper and A. Hamer. *Analytica Chimica Acta,* v. 3, Mar. 1949, p. 169-179.

154 references.

10A-66. Der Niederspannungsfunken als Lichtquelle der Quantitativen Spektralanalyse. (The Low-Voltage Arc as a Light Source for Quantitative Spectral Analysis.) J. Mika, F. Macher, and B. Vorsatz. *Analytica Chimica Acta,* v. 3, Mar. 1949, p. 228-251.

With the help of mobile and rotating mirrors and spectrophotography, a systematic study was made of the various factors which influence the nature of discharge of this type of arc. It is shown that even without a mechanical interrupter, it it possible to use not only d.c. but also a.c. if, in the case of high-frequency current, a suitable device is used. Typical results.

10A-67. Dosages polarographiques du cobalt et du fer a l'aide de nouvelles solutions de base au Trilon. (Polarographic Determination of Cobalt and Iron With Aid of a New Solution Based on "Trilon".) P. Souchay and J. Faucherre. *Analytica Chimica Acta,* v. 3, Mar. 1949, p. 252-261.

Trilon B strongly displaces the reduction potentials of numerous elements. Owing to its ready transformation to the trivalent state cobalt can be determined without preliminary separation, in presence of an excess of most other metals. The method is applied to the analysis of steels. After complex formation with Trilon B, small amounts of Fe can also be determined in the presence of an excess of other metals. The method was applied to the determination of small amounts of Fe in brasses and "pure" metals.

10A-68. Sampling and Its Uncertainties. S. S. Wilks. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 859-875; discussion, p. 876.

Mathematical and statistical methods for analyzing sampling results. Precision and accuracy of measurements. 12 ref.

10A-69. Improved Spectrographic Power Source Now Practical for Standard Metallurgical Laboratories. W. O. Everling. *Steel,* v. 124, May 16, 1949, p. 80-81, 116.

Under test for the last two years, new equipment provides energy for either the spark or arc method of quantitative analysis, meeting requirements of reproducibility, stability, and ease of operation.

10B—Ferrous

10B-31. The Determination of Combined Carbon in Cast Iron by Means of the Spekker Photo-Electric Absorptiometer. T. S. Harrison. *Journal of the Society of Chemical Industry,* v. 68, Feb. 1949, p. 49-52.

Method; data obtained.

10B-32. Fast Analysis of Acid Slags; Reflective Spectrophotometry Determines FeO-MnO-Cr. E. C. Zuppann and A. E. Martin. *American Foundryman,* v. 15, Apr. 1949, p. 126-132.

Development of a rapid method. A finely ground slag sample is mixed with oil and examined in the reflecting attachment of a standard spectrophotometer at a few key wave lengths. Reflective densities are translated into percentages of FeO, MnO, and Cr by reference to graphs. 12 ref.

10B-33. Determination of Tungsten and Columbium in Steel. (In Russian.) L. M. Budanova and K. D. Gavrilova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 7-11.

Possibility of separation of W and Cb by means of cupferron in the presence of fluoride salts. On the basis of this, a method of rapid colorimetric method for steels containing both metals was developed. The presence of up to 3% Mo does not interfere. 10 ref.

10B-34. Rapid Colorimetric Method for Tungsten Determination in Steel. (In Russian.) A. G. Bogdanchenko and A. D. Sapir. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 11-15.

New method applicable to W contents up to 1.5%. The most accurate results are obtained for W contents up to 0.50%. Time of determination is about 5 min.

10B-35. Determination of Molybdenum and Titanium in Ferroalloys and Steels by an Amalgamation Method. (In Russian.) P. Ya. Yakovlev and E. F. Pen'kova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 34-36.

Rapidity and accuracy of method are emphasized.

10B-36. Quantitative Spectrographic Determination of Carbon in Steels. (In Russian.) A. P. Oleinikov and K. I. Taganov. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 59-62.

Use of the high-frequency discharge for spectrum excitation and a method of obtaining such a discharge by making certain modifications to a standard generator. Optimum operating conditions. Experimental results.

10B-37. Determination of Molybdenum in Alloy Steels Using the Photocolorimeter. (In Russian.) A. A. Tikhonova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 107-108.

The possibility of applying a photoelectric method of analysis. The formation of the complex of molybdenum with potassium thiocyanate in an acid medium in the presence of $SnCl_2$ is the basis of reaction.

10B-38. Rapid Method for Determination of Titanium in Alloy Steels Containing Chromium and Nickel. (In Russian.) Z. P. Gutkovskaya. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 109-110.

Method based on the formation of the yellow compound $Ti(OH)_4$ or $TiO(SO_4)_2$ formed in the presence of H_2O_2.

10B-39. Automatic Welding of Thick Boiler Steels by Means of High-

Power Arcs. (In Russian.) K. V. Lyubavskii and B. I. Lazarev. *Avtogennoe Delo* (Welding), Jan. 1949, p. 7-15.

Electric-arc welding of thick steel plate up to 90 and 100-mm. thickness. The main characteristics of this process are the high amperage, up to 1800 amp. at 40 volts, and a specially developed flux having high viscosity and high stabilizing (ionizing) properties. Optimum conditions of such welding and mechanical properties of welds. 10 ref.

10B-40. Die Bestimmung von Niob und Tantal in Stählen. (Determination of Columbium and Tantalum in Steels.) Maria Waterkamp. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 5-8.

Different methods for extracting the two elements in the form of their pentavalent oxides. The proposed methods are compared with those described in earlier literature. 13 ref.

10B-41. Röntgenographische Absorptionsanalyse legierter Stähle. (Radiographic Absorption Analysis of Alloy Steels.) Helmut Krainer. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 9-12.

Principles and a rapid method involving measurement of intensities by means of an electron-counting tube. A steel analysis for W and Ta.

10C—Nonferrous

10C-61. Determination of Rare Earth Elements in Uranium Compounds. R. C. Hirt and N. H. Nachtrieb. *U. S. Atomic Energy Commission,* MDDC-903; LADC-274, June 24, 1944, 4 pages.

Separation may be obtained by means of an ether extraction, precipitation as fluorides, and purification by way of the hydroxides. The final determination is carried out spectrographically. Dysprosium, gadolinium, samarium, neodymium, praseodymium, lanthanum, and cerium were investigated, and their limits of sensitivity and their recoveries from U_3O_8 determined. The method may be applied to other rare earth elements as well.

10C-62. Extraction of Cerium (IV) Nitrate by Butyl Phosphate. J. C. Warf. *U. S. Atomic Energy Commission,* AECD-2524, Aug. 7, 1947, 10 pages.

Cerium (IV) nitrate is readily extracted from aqueous solutions by tri-n-butyl phosphate, a solvent which is reasonably stable under strongly oxidizing conditions. By oxidation with bromates and simultaneous exhaustive extraction by butyl phosphate, the cerium may be quantitatively extracted. The degree of separation of cerium from iron, zirconium, lanthanum, and praseodymium.

10C-63. The Colorimetric Determination of Traces of Bismuth in Lead. C. W. Ballard and and E. J. Ballard. *Analyst,* v. 74, Jan. 1949, p. 53-54.

Methods described by Robinson and by Zischkau. Points out disadvantages of these methods and outlines modified method. Comparative results.

10C-64. Le dosage pondéral du thorium. (Etude des précipités a l'aide de la thermobalance de Chevenard.) [Gravimetric Determination of Thorium. (Study of Precipitates With Aid of the Chevenard Thermobalance.)] Thérese Dupuis and Clément Duval. *Comptes Rendus,* v. 228, Jan. 31, 1949, p. 401-402.

Temperature limits of stability of a series of solid compounds of Th, prepared by use of different precipitating reagents. The data are discussed in terms of suitability of the different reactions for application to gravimetric determination of Th.

10C-65. Electrolytic Determination of Copper in Brasses and Bronzes, Tin-Base Alloys, and Aluminum Alloys by Use of Phosphoric Acid. George Norwitz. *Analytical Chemistry,* v. 21, Apr. 1949, p. 523-525.

The method is not applicable to Al alloys containing Sn, Sb, Bi, or Ag. 11 ref.

10C-66. Thorium Standard Samples. Clement J. Rodden. *U. S. Atomic Energy Commission,* MDDC-1220, June 1947, 18 pages.

Preparation by National Bureau of Standards as well as a series of methods for determination of Th and U in sands and ores. 11 ref.

10C-67. The Spectrochemical Determination of Hafnium-Zirconium Ratios. Cyrus Feldman. *U. S. Atomic Energy Commission,* AECD-2342, Oct. 14, 1948, 19 pages.

11 references.

10C-68. Application of a Titration Method to the Colorimetric Determination of Tungsten. (In Russian.) Yu. A. Chernikhov and R. S. Tramm. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 15-20.

Method for determination of tungsten in ores, based on formation of a colored thiocyanate-tungsten complex. Influence of different substances present. High sensitivity of this method, permitting determination of amounts as small as 0.0001%. 10 ref.

10C-69. Investigation of Colorimetric Methods of Bismuth Determination. (In Russian.) Yu. Yu. Lur'ei and L. B. Ginzburg. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 21-30.

Existing methods for ores. Data are tabulated.

10C-70. Colorimetric Determination of Bismuth in Lead Using Thiourea. (In Russian.) A. I. Busev and N. P. Korets. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 30-34.

A simple, accurate, and rapid method. Influence of different additions on the accuracy of determination.

10C-71. Application of the Intermittent Spark for Quantitative Spectral Analysis of Metals in Solution. (In Russian.) K. G. Dmitriev. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 63-65.

Method and factors involved. The method is particularly recommended for determination of Mg and Ni.

10C-72. Spectrographic Determination of Vanadium in Copper-Bearing Sandstones. (In Russian.) A. M. Shavrin. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 66-69.

Proposes a new method, using a previously plotted calibration curve. Methods of preparing standard calibration curves. Probable error of a single determination was found to be about 5-13%.

10C-73. Preparation and Investigation of Silumin Standards With a High Zinc Content. (In Russian.) N. K. Tikhomirova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 112-114.

Details of preparation of standard silumin-alloy samples for spectrographic analysis. Compositions of the standards. Comparative results of chemical and spectrographic analysis.

10C-74. Volumetric Determinations in Strongly Alkaline Solutions. VI. An Oxidimetric Determination of Manganese and Cobalt. (In English.) O. Tomicek, Z. Sandl, and V. Simon. *Collection of Czechoslovak Chemical Communications,* v. 14, no. 1-2, 1949, p. 20-27.

Procedures and typical data.

10C-75. Dosage gravimétrique du vanadium au moyen de certains dérivés de la carbamides. (Gravimetric Determination of Vanadium Using Certain Carbamide Derivatives.) J. Fidler. *Collection of Czechoslovak Chemical Communications,* v. 14, no. 1-2, 1949, p. 28-39.

New method. Results compared with those obtained by other methods. Sample determinations were performed with each organic compound. Carbamide derivatives were used as precipitation agents.

10C-76. Dosage de l'uranium a coté du Ce^{III}, Tl^{I}, Ag, Pb, Cu, Hg^{II} et du ferricyanure de potassium au moyen de l'isatine-β-oxime. (Determination of Uranium and of Potassium Ferricyanide in the Presence of Ce^{III}, Tl^{I}, Ag, Pb, Cu, and Hg^{II} by Means of Isatine-β-Oxime.) V. Hovorka and Z. Holzbecher. *Collection of Czechoslovak Chemical Communications,* v. 14, no. 1-2, 1949, p. 40-58.

Methods applicable when each of the above ions is present individually, but not collectively.

10C-77. Sur une méthode d'analyse quantitative des variétés allotropiques du cobalt par les Rayons X. (An X-Ray Method for Quantitative Analysis of Allotropic Modifications of Cobalt.) Max Sage. *Comptes Rendus,* v. 228, Feb. 14, 1949, p. 572-574.

Theoretical basis of method. The technique of the analysis, using the microphotometer of Bouty; and the method of analysis of the experimental data. Results have a maximum possible error of ±5%.

10C-78. L'acide trithiobarbiturique dans la recherche de l'argent et du cuivre. (Trithiobarbituric Acid in the Investigation of Silver and Copper.) T. Pavolini and F. Gambarin. *Analytica Chimica Acta,* v. 3, Mar. 1949, p. 180-182.

Recommends use of this reagent for identification of traces of Ag or Cu.

10C-79. Sur la thermogravimétrie des précipités analytiques. XVIII. Dosage du Scandium. (Thermogravimetric Analysis of Analytical Precipitates. XVIII. Determination of Scandium.) (Mme.) Jacques Dupuis and Clément Duval. XIX. Dosage du Praséodyme. XX. Dosage de l'Europium. XXI. Dosage de l'Aluminium. (XIX. Determination of Praseodymium. XX. Determination of Europium. XXI. Determination of Aluminum.) Therese Dupuis and Clément Duval. *Analytica Chimica Acta,* v. 3, Mar. 1949, p. 183-185; 186-188; 189-190; 190-205.

Continue series on use of the Chevenard thermobalance for gravimetric determination of various ions. Curves indicate proper temperature ranges for drying of different precipitates formed with the above elements. Only three salts each of Sc, Pr, and Eu were studied; but 24 for Al. Recommends new technique for the latter. 37 ref.

10C-80. A Rapid Mobile Analyzer for Minute Amounts of Lead in Air. Henry Aughey. *Journal of the Optical Society of America,* v. 39, Apr. 1949, p. 292-293.

Atmospheric contamination by lead presents acute problems in analysis and control in the chemical industry. Mobile instrument of extreme sensitivity which furnishes a rapid indication and an approximate assay of localized relatively high concentrations of lead, combined or elemental. Samples are drawn through a condensed spark discharge adjusted to minimize air lines and to excite the lead spectrum which is photographed with a small quartz instrument.

10C-81. Detection of Lead in Air With the Aid of a Geiger-Muller Counter.

O. G. Koppius. *Journal of the Optical Society*, v. 39, Apr. 1949, p. 294-297.

Detector which utilizes a spark source for excitation of the lead spectrum, a small quartz spectrometer for dispersion, and a quartz Geiger-Muller counter for detection. The lower limit of detection is of the order of 20 micrograms per cu. ft. 10 ref.

10C-82. A Modified Method for the Determination of Chromium in Uranium or Its Compounds. C. E. Bricker and N. H. Furman. *U. S. Atomic Energy Commission*, MDDC-1616, June 19, 1943, 5 pages.

Reviews previous methods. Results of light-transmission method using uranyl sulfate solution which requires no separations or extractions.

10C-83. A Rapid Colorimetric Method for the Determination of Microquantities of Thorium. Robert H. Hall. *U. S. Atomic Energy Commission*, AECD-2437, Nov. 12, 1948, 13 pages.

Determination with an error of 2% or less through the formation of a colored complex with excess carminic acid in acid solution. The colored complex forms almost instantaneously in cold solutions, and is stable indefinitely at room temperature. Method is not satisfactory in the presence of Fe^{+++}, Fe^{++}, Al^{+++}, and organic material which form complexes of greater coordinate band strength.

10C-84. Volumetric Determination of Columbium. Howard B. Knowles and G. E. F. Lundell. *Journal of Research of the National Bureau of Standards*, v. 42, Apr. 1949, p. 405-408.

A procedure whereby Cb, in H_2SO_4 solution, is quantitatively reduced by amalgamated zinc to the trivalent form and subsequently oxidized to the quinquevalent state.

10D—Light Metals

10D-15. Studies on the Color Reaction of Beryllium With Alkanet Preparations. A. L. Underwood and W. F. Neuman. *U. S. Atomic Energy Commission*, AECD-1982, Apr. 9, 1948, 9 pages.

Colorimetric method for determination of small amounts of beryllium using a compound isolated from alkanet root. Effects of pH, concentration of reagent, time of standing, heating, and several common ions. Accuracy is quite satisfactory.

10D-16. Rappel et discussion des plus récentes méthodes pour le dosage rapide des éléments d'addition et des impuretés des alliages légers en vue d'assurer la constance de leur composition. (Review and discussion of the Most Recent Rapid Methods for Determination of Alloying Elements and Impurities in Light Alloys in Order to Assure the Constancy of Their Composition.) J. Navarro. *Revue de Métallurgie*, v. 46, Jan. 1949, p. 8-12.

Rapid methods of determination of Cu, Mn, Mg, Fe, Si, Pb, Zn, Ni, Cr, and Ti in light alloys.

10D-17. Determination of Chromium in Aluminium Alloys Using a Photocolorimeter. (In Russian.) A. A. Tikhonova. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 108-109.

Method and reagents.

10D-18. Influence of Additions on the Aluminum Spectrum. (In Russian.) G. I. Zhuravlev and V. P. Malyavkina. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 115-117.

The influence of additions of Mn, Mg, Fe, Si, Cu and Zn on the intensities of aluminum lines used as references during spectrographic analysis of Al alloys.

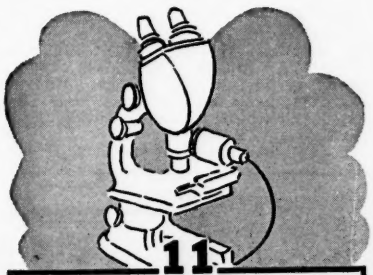
10D-19. Spectrographic Analysis of Aluminium Alloys During Excitation of the Spectrum by an Alternating-Current Arc With an Interruptor. (In Russian.) V. D. Mikhalevskii. *Zavodskaya Laboratoriya* (Factory Laboratory), v. 15, Jan. 1949, p. 117-119.

When applying a mechanical interruptor to an a.c. arc, accuracy of analysis was shown to be sufficient for rapid analysis of aluminum alloys.

10D-20. Dosage colorimétrique du manganese et du chrome. (Colorimetric Determination of Manganese and of Chromium.) S. Lacroix and M. Labalade. *Analytica Chimica Acta*, v. 3, Mar. 1949, p. 262-271.

Cr and Mn are oxidized by periodate and determined colorimetrically under well defined optical conditions. In simple cases Mn can be determined to about 0.3% and Cr to about 0.5%. The method was applied to determination in Al alloys and bauxites. 23 ref.

10D-21. The Use of Solochrome Cyanine as a Colorimetric Reagent for Beryllium With Special Reference to the Determination in Magnesium and Its Alloys. C. H. Wood and H. Isherwood. *Metallurgia*, v. 39, Apr. 1949, p. 321-323.



11 APPARATUS, INSTRUMENTS and METHODS

11-139. Une méthode de recherche et d'essai: le meulage en atmosphere raréfiée, associé a l'emploi de la diffraction électronique. (A Method for Research and Testing: Grinding in Vacuum Associated With Electron-Diffraction Investigation.) R. Courtel. *Revue de Métallurgie*, v. 46, Jan. 1949, p. 24-26.

See abstract of article from *Métaux & Corrosion*, item 11-230, 1948.

11-140. A New Method for Determining Austenitic Grain Size of Cast Steel. E. J. Eckel and S. J. Paprocki. *American Foundrymen's Society*, Preprint 5, 1949, 5 pages.

Method based on the intergranular diffusion of bronze into steel at elevated temperatures. It requires neither special apparatus nor difficult techniques, takes little time, and gives results said to be generally superior to those obtained by other methods.

11-141. Metallography of Cast Magnesium Alloys. P. F. George. *American Foundrymen's Society*, Preprint 22, 1949, 16 pages.

Method of metallographic specimen preparation, grinding and polishing, composition of etchants and specimen-etching techniques, interpretation of microconstituents and microstructures in magnesium alloys.

11-142. Application of Harmonic Analysis in Electronography. (In Russian.)

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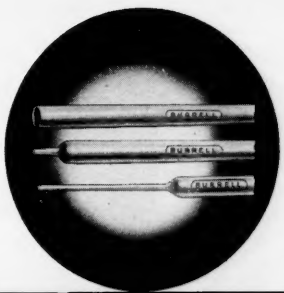

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B. K. Vainshtein and Z. G. Pinsker. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 1, 1949, p. 49-52.

Technique for application to electron-diffraction analysis of crystal structures. Mathematical development and graphical interpretation.

11-143. A New Magnetic Method for Measuring the Thickness of Composite Copper-Nickel Coatings. Abner Brenner and Eugenia Kellogg. *Instruments*, v. 22, Apr. 1949, p. 323.

The method involves measurement of the attractive force between the plated specimen and two permanent magnets of different strengths. The values thus obtained are used, in conjunction with a set of previously-determined calibration curves for each magnet, to obtain the total thickness of the coating and the relative thicknesses of the copper and nickel layers.

11-144. Metallographic Technique for Steel; Polishing. (Continued.) *Metal Progress*, v. 55, April, 1949, p. 504B.

Photomicrographs illustrate comparative flatness at edge of specimen; preservation of edges by iron plating; comparison of electrolytic and mechanical polishing; and false structure resulting from disturbed metal in 18-8.

11-145. Metallography of Aluminum Casting Alloys. A. M. Montgomery. *American Foundryman*, v. 15, Apr. 1949, p. 115-121.

Microscopic examination may reveal method of casting; type of alloy; type and extent of heat treatment; grain size; presence of voids, inclusions, or segregation; type and thickness of surface coatings; type and extent of corrosion; or type of fracture in a casting failure. Each of these applications to Al casting alloys is described following a discussion of the selection of specimens and the various polishing operations.

11-146. Divergent-Beam X-Ray Photography. W. May. *Nature*, v. 163, Apr. 9, 1949, p. 569-570.

Procedure and results of application to Al single crystals.

11-147. Lead Sulfide Photoconductive Cells. S. Pakswer. *Electronics*, v. 22, May 1949, p. 111-115.

Practical operating data and characteristics of recently improved cells. Present applications include sound-on-film transducers using infrared instead of conventional light sources, spectrophotometry, pyrometry, and industrial controls. 17 ref.

11-148. Etude aux rayons X de la répartition des dimensions des cristallites dans une poudre cristalline. (X-Ray Investigation of the Distribution of Crystallite Dimensions in a Crystalline Powder.) Félix Bertaut. *Comptes Rendus*, v. 228, Feb. 7, 1949, p. 492-494.

Mathematical development of a method for determining distribution from X-ray diffraction patterns.

11-149. Sur la détermination des indices et des épaisseurs des couches minces. (Determination of Indexes and Thicknesses of Thin Layers.) Florin Abeles. *Comptes Rendus*, v. 228, Feb. 14, 1949, p. 553-555.

New optical method. Theoretical bases. Technique of the method, application, and graphical interpretation of the results.

11-150. Frottement interne et anisotropie élastique des métaux et alliages. (Internal Friction and Elastic Anisotropy of Metals and Alloys.) Robert Cabarat, Léon Guillet, and René Le Roux. *Comptes Rendus*, v. 228, Feb. 14, 1949, p. 570-572.

Method using the specially developed apparatus of Cabaret. Results of determinations for Mg, Al, Fe, Pt, Cd, and Zn. It is believed that this method can also be applied to various alloys.

11-151. Cathodic Vacuum Etching of Metals. Don M. McCutcheon. *Journal of Applied Physics*, v. 20, Apr. 1949, p. 414-415.

Comparison of cathodic pattern with the best chemically etched micrograph showed that cathodic treatment brought out the true microstructure with greater detail and clarity. Experimental technique for bringing out flow-lines in steel.

11-152. Spherical Particles for Electron Microscopy. G. David Scott. *Journal of Applied Physics*, v. 20, Apr. 1949, p. 417-418.

Usefulness in electron microscopy of Polystyrene Latex, No. 580G, which is a water suspension of spherical particles of remarkable uniformity of size. Measurements taken recently using a sample of this latex indicate that though the particles on any mount are of nearly uniform size within the limits of error, the same average size is not obtained consistently. Some method of ensuring uniformity of size is required before they can be used generally for precise size measurements.

11-153. A Device for Producing an Easily Identified Area on the Electron Microscope Specimen Screen. Francis W. Bishop. *Review of Scientific Instruments*, v. 20, Apr. 1949, p. 324-325.

Simple marking device consisting of a female brass block, counterbored to hold a specimen screen and a male element which holds a sewing needle of appropriate dimensions. The point of the needle may be adjusted for any degree of pene-

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11-154. Polishing Mineral Specimens. A. F. Hallimond. *Mining Magazine,* v. 80, Apr. 1949, p. 213-215.

A triple holder suitable for an ordinary rotating lap.

11-155. Electrical Controls in Thread-Grinder Design. E. V. Flanders. *Mechanical Engineering,* v. 71, May 1949, p. 381-388.

Reason for recent advances and typical examples.

11-156. High Speed Motion Pictures Aid in Analysis of Production Processes. Richard O. Painter. *Iron Age,* v. 163, May 5, 1949, p. 82-87.

How cameras operating at speeds up to 10,000 frames per sec. are used in miscellaneous studies, including metal-cutting-tool action, electrical conditions associated with mechanical contacts, and machining and cold heading studies in particular.

11-157. The Measurement of Permeability and Magnetic Losses of Non-Conducting Ferromagnetic Material at High Frequencies. H. J. Lindenhovius and J. C. van der Breggen. *Philips Research Reports,* v. 3, Feb. 1948, p. 37-45.

Rapid and accurate method. Some data obtained with compressed iron powder and with ferroxcube.

11-158. Methoden der Strukturforschung. (Methods of Structural Investigation.) Richard Glocker. "Physics of Solids" *(Office of Military Government for Germany),* Part I, p. 1-14.

Reviews German contributions, 1939-46. 75 ref.

11-159. On Variation in Materials, Testing, and Sample Sizes. Leslie E. Simon. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 877-881; discussion, p. 882-885.

Previously abstracted from preprint. See item 11-167, 1948.

11-160. A High-Temperature X-Ray Camera for Use With Plate Specimens. E. A. Owen. *Journal of Scientific Instruments and of Physics in Industry,* v. 26, Apr. 1949, p. 114-117.

Camera for use at temperatures up to apout 1000° C. It is arranged so that the specimen rotates in its own plane and is at the same time oscillated through small angles about a vertical in its surface. Indirect modes of temperature measurement. Samples of structure-spectra taken with a double specimen, aluminum and silver, at different temperatures.

11-161. Electrolytic Polishing of Iron and Steel. J. Pow. *Metal Treatment and Drop Forging,* v. 16, Spring 1949, p. 31-37.

Jacquet method for electro-polishing of ferrous specimens for microscopic examination.

11-162. Decomposition of Nital Etching Solutions. Howard H. Fawcett. *Metal Progress,* v. 55, May 1949, p. 659.

Violent decomposition, indicating need for special safety precautions.

11-163. Graphitization Rating Chart. D. B. Collyer and J. O. Light. *Metal Progress,* v. 55, May 1949, p. 664B.

Rating is done by comparing particle size in a microscopic image at 500 diam. magnification with the chart presented and by counting the particles in a 4 x 5-in. field on a ground-glass screen.

11-164. X-Ray Diffraction in Research. H. Lipson. *Research,* v. 2, May 1949, p. 202-209.

Survey of varied applications.

11-165. Thickness Tester for Tinplate Coatings. *Iron Age,* v. 163, May 12, 1949, p. 89.

A brief report. See abstract of "The Francis Thickness Tester: Application to the Measurement of Electrolytic and Hot-Dipped Tinplate Coatings," K. W. Caulfield and W. E. Hoare. *Sheet Metal Industries,* item 11-136, 1949.

11-166. (Book) **The Instrument Manual.** 548 pages. United Trade Press, Ltd., 24, Bride Lane, London, E.C.4, England. 70s.

General information on industrial instruments operating on mechanical, optical, electrical, hydraulic, and pneumatic principles, for various industries, such as the engineering, textile, chemical, and metallurgical. Equipment for temperature and time determination, electrical and fluid-flow measurement, and for industrial-process control. Recent applications of electronics to instruments, such as the use of the Magnetron, the cathode-ray tube, and high-frequency heating.

11-167. (Book) **Minerals and How to Study Them. Ed. 3.** Edward Salisbury Dana. Revised by Cornelius S. Hurlbut, Jr. 323 pages. 1949. John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. $3.90.

Although much of the book has been rewritten, an effort has been made to maintain the same point of view for the same reader—the beginner in mineralogy. The sections on crystallography and physical mineralogy cover much the same ground as previously, but the chapters on chemical properties of minerals and the use of the blowpipe have been somewhat shortened. The chapter on description of mineral species has been completely rearranged and rewritten.

11-168. (Book) **Radioactive Measurements With Nuclear Emulsions.** Herman Yagoda. 356 pages. 1949. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

A coordinated study on the use of photographic emulsions in measuring radioactivity. The theory underlying the chemical and photographic operations involved; working methods in the fields of biology, radio-chemistry, metallurgy, mineralogy, and nuclear physics. 645 ref.

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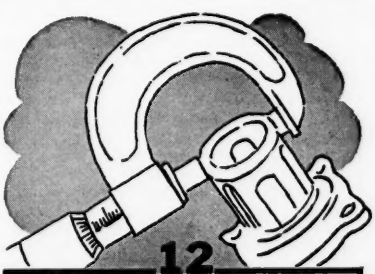

12 INSPECTION and STANDARDIZATION

12-75. Tube Quality Control. Milton Schor. *Modern Packaging,* v. 22, Apr. 1949, p. 187-189.

New methods of assuring that enamel, cap, and coating of collapsible tubes will be compatible with product and use.

12-76. Standard Specifications for Elevated Steel Water Tanks, Standpipes and Reservoirs. *Journal American Water Works Association,* v. 41, Apr. 1949, p. 357-396.

Approved specifications of American Water Works Association, American Welding Society, and New England Water Works Association.

12-77. Code Inspection on Welded Pressure Vessels. Floyd F. Johnson. *Welding Journal,* v. 28, Apr. 1949, p. 364.

12-78. Electronic Thickness Gage Reduces Amount of Off-Gage Steel. *Steel,* v. 124, Apr. 25, 1949, p. 83-84.

Gage does not touch material, eliminating marring; is applicable to other materials in strip or sheet form; and gives continuous reading regardless of rate of movement.

12-79. Comparative Tool Steel Brands. *Iron Age,* v. 163, Apr. 28, 1948, p. 85-86.

A tabular compilation of comparable toolsteel trade names, brought together under ASM class and alloy class.

12-80. Nondestructive Testing Laboratory. *Electronics,* v. 22, May 1949, p. 154, 156, 158.

Equipment of new Naval Ordnance Laboratory—reputed to be the most complete laboratory of X-ray and other nondestructive testing apparatus in the world.

12-81. The Consumer Looks at Steel Specifications. Part II. Muir L. Frey. *Steel Processing,* v. 35, Apr. 1949, p. 200-201, 208-210.

Availability of steels, method of ordering, hardenability bands, and H-steels.

12-82. Streamlined Specifications: Metals. Ben John Small. *Progressive Architecture,* v. 30, May 1949, p. 92-95.

General requirements, materials, gages, and treatments of structural steel, steel joists, miscellaneous metals, ornamental metals, metal specialties, and hollow metals used by architects.

12-83. How Costs Can Be Cut by Properly Timed Inspection. James L. Erickson. *Production Engineering & Management,* v. 23, May 1949, p. 45-48.

Process inspection is divided into sub-inspection stations and the duties of each.

12-84. Recording Gage for Control of Quality at the Machine. C. W. Kennedy. *Factory Management and Maintenance,* v. 107, May 1949, p. 115-117.

Automatically records measurements on continuous tape marked with statistical control limits.

12-85. Special Inspection Fixture for Precision Forgings. *Tool & Die Journal,* v. 15, May 1949, p. 56, 58.

Used to check golf-club heads.

12-86. Rigid Inspection Precedes Successful Broaching. *Tool & Die Journal,* v. 15, May 1949, p. 66, 68.

Examples showing need for careful checking of broach design and metallurgical specifications. Inspection equipment.

12-87. Ultrasonic Weld Inspection. John C. Smack. *Welding Engineer,* v. 34, May 1949, p. 17-20.

Recent improvements which adapt the "reflectoscope" to weld inspection. Ultrasonic vibrations are projected through the plate at an angle by successive reflections and returned when a defect is encountered.

12-88. The Amount of Inspection as a Function of Control of Quality. G. R. Gause. *American Society for Testing Materials, Proceedings,* v. 48, 1948, p. 886-893; discussion, p. 894-895.

Simple summaries of inspection results obtained on samples from prior lots of product afford the nec-

essary measures of the degree to which quality of that particular product is controlled and can be used to determine when the amount of inspection should be reduced or increased. Techniques for making these summaries.

12-89. Magnetic and Inductive Non-Destructive Testing of Metals. I. R. Robinson. *Metal Treatment and Drop Forging,* v. 16, Spring 1949, p. 12-24.

Various techniques. 83 ref.

12-90. The Inspection and Testing of Die Castings. H. K. Barton. *Machinery* (London), v. 74, Apr. 28, 1949, p. 550-554.

Various procedures.

12-91. The Classification Societies and Aluminium Alloys. R. B. Shepheard. *Engineering,* v. 167, Apr. 22, 1949, p. 384. A condensation.

British Al-alloy specifications indicating types suitable for various marine applications.

12-92. How the New Thread Standard Affects You. Herman H. Lind. *Fasteners,* v. 5, no. 4, [1949], p. 7-9.

Answers questions about the above. Class 2A and 2B tolerances, allowance, and crest clearances.

12-93. Control and Inspection for Quality Welds. J. Lyell Wilson. *Welding Journal,* v. 28, May 1949, p. 443-452.

Proved inspection methods and ideas surrounding their application in shipbuilding, pressure vessels, and piping described and illustrated. Macrographs of failed or defective welds. 24 ref.

12-94. Prolonging Copper-Tungsten Electrode Tip Life. D. J. Rahn. *Welding Journal,* v. 28, May 1949, p. 453-455.

Careful control in manufacture of resistance-welding electrodes and their inspection by the purchaser insure better service and longer tip life. Recommendations for grain structure. Recommended use techniques.

12-95. Gamma Ray Radiography of Drag-Type Rotary Drill-Bit Blades. J. M. Williams. *Oil and Gas Journal,* v. 48, May 12, 1949, p. 80-81.

Procedures and results.

12-96. Acme-Thread Measurement With Wires. J. S. Rojahn. *American Machinist,* v. 93, May 19, 1949, p. 145.

Calculations for measurement of pitch diameter.

12-97. (Book) **SAE Iron and Steel Standards and Specifications. 1948.** Society of Automotive Engineers, Inc., 29 West 39th St., New York 18, N. Y. (Special Publication No. 30.) Reprint from SAE Handbook, 1948, p. 285-406. $3.00, nonmembers; $1.50, members.

12-98. (Book) **SAE Non-Ferrous Metals, Standards and Specifications, 1948.** Society of Automotive Engineers, Inc., 29 West 39th St., New York 18, N. Y. Reprint from SAE Handbook, 1947, p. 401-492.

For additional annotations indexed in other sections, see:

7C-23; 12-91; 14A-62; 14B-53

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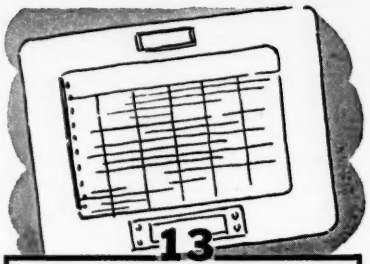


13 TEMPERATURE MEASUREMENT and CONTROL

13-32. A Modification of the Gouy Modulator. L. S. Darken. *Review of Scientific Instruments,* v. 20, Apr. 1949, p. 323-324.

Improved device for temperature control up to 1650° C. Cyclic temperature variation near 900° C. was reduced from 8 to 0.3° C. Advantages include: absence of any moving contacts in the thermocouple circuit; absence of any wired connection between thermocouple circuit and any other circuit; true zero mean cyclic voltage; failure of the modulator leads merely to absence of modulation and does not otherwise disrupt control; and no metal other than copper is used in the circuit.

13-33. Quality Control in the Open Hearth. Part IV. Use of Bath Immersion Pyrometers. (Concluded.) Frank G. Norris. *Industrial Heating,* v. 16, Apr. 1949, p. 646, 648, 650.

Essential details of construction, maintenance and operation for optimum results, for accurate bath readings and drastic reduction of skull losses.

13-34. Method of Investigation of Temperature Distribution in the Working Space of Furnaces. (In Russian.) N. P. Zgonnik. *Ogneupory* (Refractories), Jan. 1949, p. 28-30.

Different methods for the above, such as pyrometric cones, differential thermocouples, and an indirect method based on contraction of certain ceramic materials during baking. The last method is particularly recommended for temperatures of 1150-1550° C.

13-35. Les Compensateurs d'Inertie Thermique. (Compensators for Thermal Inertia.) J. Bernot. *Journal du Four Electrique et des Industries Electrochimiques,* v. 58, Jan.-Feb. 1949, p. 20-22.

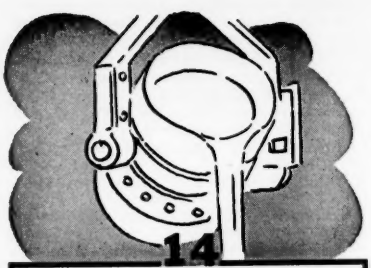
Proposes a new type of compensator for temperature regulators. Details of construction. (To be continued.)

13-36. Temperature Measurement in Metallurgical Industries. A. Linford. *Metal Treatment and Drop Forging,* v. 16, Spring 1949, p. 38-48.

Theory of various temperature-measuring techniques, recent developments, and typical commercial instruments.

13-37. "Heat Inertia" in Problems of Automatic Control of Temperature. Part III. Actual Controllers. Victor Broida. *Instruments,* v. 22, Apr. 1949, p. 324-325, 362, 364, 366.

A series of automatic temperature controllers, each corresponding to one of the automatic-control systems studied theoretically. Similarity between theoretical conclusions drawn from mathematical study of these systems and experimental observations. (To be continued.)



14 FOUNDRY PRACTICE

14A—General

14A-50. Causes of Rat-Tail Casting Defects. *American Foundrymen's Society,* Preprint 4, 1949, 9 pages.

Final report of A.F.S. committee on physical properties of iron-foundry molding materials at elevated temperatures. Details of work on five sands which had caused trouble. Effects of ingredients added in attempts to eliminate the difficulties. Appendix discusses the expansion test for molding sands.

14A-51. Design and Operation of a 10-in. Diameter Cupola. D. E. Krause and H. W. Lownie, Jr. *American Foundrymen's Society,* Preprint 12, 1949, 9 pages.

Cupola has been successfully operated for over three years. It was designed to reproduce large commercial units as closely as possible in all respects except size. Research investigations on effects of moisture in the blast, effects of rusty scrap in the charge, relative refractoriness of various lining materials, and comparisons of the operating characteristics of different foundry cokes. Details of construction, and some modifications for special purposes.

14A-52. Plastic Binders for Foundry Sand Practice. H. K. Salzberg. *American Foundrymen's Society,* Preprint 18, 1949, 9 pages.

Principles useful in formulating core sand mixes with plastic binders. Means of improving green strength and workability of core sand mixes. Both urea and phenol resin types of binder were investigated. Types of castings particularly improved by use of plastic-bonded cores. 13 ref.

14A-53. Casting Surface Finish. H. H. Fairfield and J. MacConachie. *American Foundrymen's Society,* Preprint 24, 1949, 5 pages.

Surface finish is measured by weighing a test casting, buffing it to a smooth finish, and reweighing the casting. The loss in weight is used as an index of casting finish. Experiments are limited to the casting of 85-5-5-5 bronze into No. 1 Albany natural molding sand. The effect of mold hardness, moisture content, metal temperature, and method of filling the flask.

14A-54. Modern Foundry Core and Mold Ovens. Charles A. Barnett. *American Foundrymen's Society,* Preprint 36, 1949, 21 pages.

Advantages of proper selection of this equipment.

14A-55. A Study of the Principles of Gating. R. E. Swift, J. H. Jackson, and L. W. Eastwood. *American Foundrymen's Society,* Preprint 55, 1949, 13 pages.

Equipment and procedure using motion-picture photography of the flow of water through lucite pouring boxes, sprues, and into lucite molds. Bubble formation in such

systems is believed to give some indication of gas entrainment to be expected in actual casting practice and to show how it may be minimized by design modifications. Study of effects of porosity made by drilling tiny holes in the mold walls at various points. Recommendations for changes in gating-system design. 11 ref.

14A-56. Le bentoniti e le argille in fonderia. (Bentonite and Clay in the Foundry.) Pietro Rossignoli. *La Metallurgia Italiana,* v. 41, Jan.-Feb. 1949, p. 19-22.

Some of the properties of bentonite from different sources and with different swelling powers were examined in order to determine relationships between the gel-forming power of the bentonite and the cohesive properties of the synthetic sand produced. It was concluded that there is no relation between the two properties.

14A-57. Expanding Research Program Advances Foundry Industry. *American Foundryman,* v. 15, Apr. 1949, p. 66-72.

AFS-sponsored research program in foundry fundamentals being conducted as eight projects at various U. S. and Canadian technical institutions.

14A-58. 6 Ways to Mechanize a Foundry. Henry W. Zimnawoda. *American Foundryman,* v. 15, Apr. 1949, p. 79-90.

14A-59. Foundry Practice. N. H. Keyser. *Metals Review,* v. 22, Apr. 1949, p. 5-7.

New developments of 1948, giving references to "A.S.M. Review of Metal Literature."

14A-60. A Practical Method for Determining Heat Abstraction by Molding Materials. T. T. Rick. *Iron Age,* v. 163, Apr. 21, 1949, p. 74-77.

Simple, practical method using a standard cup mold in which two thermocouples are embedded. Results of the use of this test on eight molding-sand mixes and cast iron.

14A-61. Electric Motors in Engineered Production. Paul Graham. *Western Machinery and Steel World,* v. 40, Apr. 1949, p. 66-69, 90-91.

Equipment and procedures. Foundry, press, and machining operations.

14A-62. Casting Inspection. J. Howard Williams. *Foundry Trade Journal,* v. 86, Apr. 7, 1949, p. 303-312; Apr. 14, 1949, p. 341-349; Apr. 21, 1949, p. 365-368.

Composed of a number of opinions, descriptions of methods, criticisms, relative to many aspects of casting inspection in the small general foundry where high-grade metals and intricate precision castings are produced in small or medium batches; it does not attempt to cover problems peculiar to mass production in fully mechanized foundries.

14A-63. Precision Casting. Alan Whittaker. *Machinery* (London), v. 74, Apr. 21, 1949, p. 514-516.

The lost-wax process used in the manufacture of rotor and compressor blades for gas turbines.

14A-64. Economics of Castings and Weldings. E. C. Moore. *Machinery* (London), v. 74, Apr. 21, 1949, p. 517-519.

Products considered are limited to machine frames and members within the weight range of 10-35 tons, including those for accurate machine tools and semifinishing machines. Labor and material figures are based on one area of Britain.

14A-65. Atlas of Defects in Castings. Series I. Ed. 2. *Institute of British Foundrymen,* 1948, 34 pages.

40 different types of defects. Causes and suggested remedies.

14A-66. Cast Laminated Metallic Materials. J. S. Vanick. "Engineering Laminates" (John Wiley & Sons, 1949) p. 463-482.

Chill-cast metal; chill or sand-cast duplex metal; solidified casting surface coated with liquid metal; casting surface coated by absorption of alloys; and weld-coated, spray-coated, dip-coated, and electroplated casting surfaces. Applications.

14A-67. Ohio Foundry Sands. Douglas C. Williams. *Engineering Experiment Station News* (Ohio State University), v. 21, Apr. 1949, p. 7-10.

Results of survey and of laboratory investigation.

14B—Ferrous

14B-51. Growth and Scaling Characteristics of High-Silicon Cast Iron. W. H. White and A. R. Elsea. *American Foundrymen's Society,* Preprint 25, 1949, 15 pages.

Theories of the growth mechanism. Experimental work to develop a superior growth-resistant cast iron for casting in the average gray-iron foundry, to demonstrate the advantages to be gained from use of high-Si cast iron for applications requiring growth resistance, and to increase ductility of the inherently brittle high-Si cast iron by use of small alloy additions. Results of various growth, scaling, and mechanical tests on specimens of high-Si and ordinary cast iron, both alloyed and unalloyed. 38 ref.

14B-52. Modern Foundry Methods. *American Foundryman,* v. 15, Apr. 1949, p. 122-125.

Production of miscellaneous gray-iron castings.

14B-53. Quality Control in the Foundry. Roscoe C. Byers and Joseph Dickman. *Foundry,* v. 77, May 1949, p. 102-105, 272, 274.

Quantitative information can be treated statistically to predict chemistry variation, dimensional variations, and machinability of castings.

14B-54. Core Dipping and Spinning. Arthur H. Allen. *Foundry,* v. 77, May 1949, p. 108-111.

Changes in equipment and practices made to improve block castings for Ford V-8 power plants. Schematic diagram showing elevation details of the automatic dipping and spinning conveyor and subfloor tank.

14B-55. Core Sand Practice in the Malleable Iron Foundry. Eric Welander. *Foundry,* v. 77, May 1949, p. 120-122, 262, 264.

Principal requirements of cores. Basic fundamentals of incorporating these properties into suitable cores at a reasonable cost.

14B-56. Roll Founding—Some Physical and Metallurgical Factors. W. G. Scott. *Blast Furnace and Steel Plant,* v. 37, Apr. 1949, p. 447-451, 476.

Previously abstracted from *Iron and Steel,* item 14B-10, 1949. (To be continued.)

14B-57. Construction of Cast Iron Equipment. J. Nixon Bewsher. *Industrial Chemist and Chemical Manufacturer,* v. 25, Apr. 1949, p. 219-221, 224.

General applications of cast iron in chemical-engineering equipment; foundry methods and design principles are considered. (To be continued.)

14B-58. Rolling Mill Components: Steel Castings in the Design of Large Units Subjected to Heavy-Duty Conditions. *Iron and Steel,* v. 22, May 1949, p. 151-153, 176.

Castings and their manufacture.

14C—Nonferrous

14C-38. Problem of Gases in the Indirect-Arc Furnace; Melting Brass and Bronze. Martin G. Dietl. *American Foundryman,* v. 15, Apr. 1949, p. 99-102.

Causes of gassed metal, indicating that the defect is caused by "outside" influences rather than by use of the above type of furnace. Recommended procedures for minimizing this condition, for Cu-Sn alloys and for brasses containing considerable Zn and P. 11 ref.

14C-39. Die-Casting Practice and Technique. IX. Gravity Die Design Forms. W. M. Halliday. *Metal Industry,* v. 74, Apr. 1, 1949, p. 247-250; Apr. 8, 1949, p. 271-273.

Design principles.

14C-40. Die-Casting Practice and Technique. X. Forms of Gravity Die Designs. W. M. Halliday. *Metal Industry,* v. 74, Apr. 15, 1949, p. 290-292; Apr. 22, 1949, p. 307-310.

Described and diagrammed.

14C-41. Art Foundry Practice. A. R. Wizard. *Foundry Trade Journal,* v. 86, Apr. 28, 1949, p. 389-395; discussion, p. 395-397.

Various procedures for bronze founding of statues. Steps in the production of the Roosevelt statue erected in London.

14C-42. Die Casting Die Design. Part III. (Continued.) H. K. Barton and James L. Erickson. *Tool & Die Journal,* v. 15, May 1949, p. 51-52, 54.

Relative merits of different designs for a simple casting and for a tube fitting with branches set at an angle of 85° to the axis of the main bore. (To be continued.)

14C-43. Zinc Alloys for Blanking and Forming Dies. Gilbert P. Muir. *Tool Engineer,* v. 22, May 1949, p. 32-33.

Temporary dies for sheetmetal working result in marked economies. Making of the pattern, foundry practice, and design considerations.

14C-44. (Book) **Process Control of Brass and Bronze Foundry Procedure.** 87 pages. *Society of Automotive Engineers, Inc.,* 29 West 39th St., New York 18, N. Y. $4.00, nonmembers; $2.00, members. (Special Publication 52.)

Result of the work of an SAE subcommittee. Applications, composition, and properties; test bar practices; brass and bronze foundry molding and core sand; alloying and melting of copper, brasses, bronzes; sand casting of brass and bronze; centrifugal casting of brass and bronze; pressure casting of brass and bronze; plaster mold method of casting brass and bronze; salvage-reclamation of castings by repairs; and inspection.

14D—Light Metals

14D-21. Light-Alloy Founding in France. *Light Metals,* v. 12, Apr. 1949, p. 180-187; discussion, p. 187. Based on review by Charles Roinet, *Revue de l'Aluminium,* June, July, and Sept. 1948.

Severely criticizes the general state of development and technique in the French industry.

14D-22. Correlation of Cooling Curve Data With Casting Characteristics of Aluminum Alloys. E. E. Stonebrook and W. E. Sicha. *American Foundrymen's Society,* Preprint 7, 1949, 8 pages.

Cooling-curve data for a number of commercial Al casting alloys were used to develop a type of solidification curve which shows with reasonable accuracy the relative proportions of an alloy solidifying at different temperatures. This fun-

damental study of the effect of alloy composition on the manner in which solidification occurs is supplemented by a mathematical method of analysis.

14D-23. Cast Large Aluminum Wheel; Dry Sand Cores Used as Pattern Equipment. Louis Schmidt. *American Foundryman*, v. 15, Apr. 1949, p. 133-135.

Unusual pattern equipment and molding method used to cast a wheel 72 in. in diameter, with a maximum height of 33 in. and a finished weight of about 1000 lb. No two sections between the spokes were of equal dimensions and average wall thickness was only $\frac{7}{16}$ in.

14D-24. Heat and Temperature Control in the Die Casting of Light Metals. James L. Erickson. *Light Metal Age*, v. 7, Apr. 1949, p. 12-13, 21-24, 29.

Recommended procedures.

14D-25. Magnesium Casting Operations at West Coast Plant. W. J. Granberg. *Light Metal Age*, v. 7, Apr. 1949, p. 14-15.

Procedures and equipment of Morley Magnesium Foundries.

14D-26. Diesel Pistons; An Improved Specialloid Design Made by New Production Methods. *Automobile Engineer*, v. 39, Apr. 1949, p. 147-149.

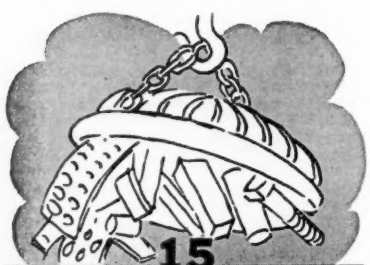
Type made by British firm of Specialloid, Ltd. Stress distributions determined experimentally for different designs, on the basis of which the design adopted was developed. Die-casting procedure. Comparative fatigue properties of pieces from five different locations from chill-core and sand-core pistons show superiority of the former.

14D-27. Automatic Ladling. *Die Castings*, v. 7, May 1949, p. 31-33, 66.

Development of an automatic ladling unit for transferring molten aluminum into the die-casting injection cylinder promises to speed production and reduce rejects.

For additional annotations indexed in other sections, see:

2B-140; 16B-58; 24A-70; 25A-68



15 SCRAP and BYPRODUCT UTILIZATION

15-26. Recovery of Sulphur From Smelter Gases by the Orkla Process at Rio Tinto. H. R. Potts and E. G. Lawford. *Bulletin of the Institution of Mining and Metallurgy*, No. 509, Apr. 1949, p. 1-36.

Using the process developed in Norway by Lenander, sulfur is recovered as a by-product of copper smelting. Chemical principles, the plant, and plant practice. A brief description of smelting practice. Recovery rarely exceeds 55% and 9.5-11.0% coke must be added to the pyrites. Attemps are being made to improve the yields.

15-27. Modern Slag Processing Plant. *Rock Products*, v. 52, May 1949, p. 63-66, 96.

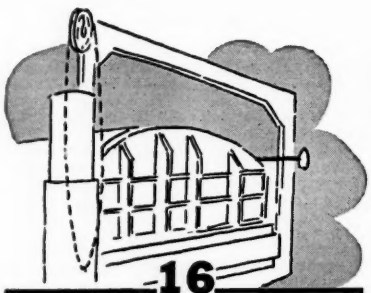
Extensive use of magnetic separators in plant to remove iron bearing-materials. Fines have many new applications in the manufacture of glass and for soil conditioning.

15-28. Reclamation of Copper From Scrap. W. H. Dennis. *Mine & Quarry Engineering*, v. 15, May 1949, p. 151-154.

Smelting process, including flow diagram.

15-29. Disposal of Plating Room Wastes. I. A Critical Review of the Literature Pertaining to the Disposal of Waste Cyanide Solutions. Barnett F. Dodge and D. C. Reams. *Plating*, v. 36, May 1949, p. 463-469, 512.

References will be published in the concluding installment. (To be continued.)



16 FURNACES and HEATING DEVICES

16A—General

16A-33. Some Simplified Heat Transfer Data. Margaret Fishenden and O. A. Saunders. "Waste-Heat Recovery From Industrial Furnaces," 1948, p. 38-66.

Some of the basic data. Actual heat transfer coefficients, which can be read off directly from curves, have been worked out for some of the most important cases. "Similarity" methods of correlation upon which they are largely based.

16A-34. An Experimental Determination of the Factors Governing the Design of Regenerators With Special Reference to Coke Ovens. T. C. Finlayson and A. Taylor. "Waste-Heat Recovery From Industrial Furnaces," 1948, p. 67-117.

Description and diagrams of full-sized experimental plant, including use of a plastic model to check gas distribution. 15 ref.

16A-35. Tubular Metallic Recuperators. G. N. Critchley and H. R. Fehling. "Waste-Heat Recovery From Industrial Furnaces," 1948, p. 118-164.

Waste-gas heat content, technical and economic possibilities for its recovery, optimum recuperator design, and selection of recuperator materials. 37 ref.

16A-36. Waste-Heat Recovery in the Metallurgical Industry. J. A. Kilby, W. G. Cameron, E. C. Evans, A. H. Leckie, J. L. Harvey, and A. E. Balfour. "Waste-Heat Recovery From Industrial Furnaces," 1948, p. 242-337.

Results of a comprehensive study of methods, equipment, and economics for the wide variety of furnace, boiler, and oven equipment used. 25 ref.

16A-37. Induction Does Some Odd Jobs. Frank W. Curtis. *American Machinist*, v. 93, Apr. 21, 1949, p. 81-83.

Variety of unusual operations including drying, bonding, debonding, and sealing handled by induction heating.

16A-38. Furnace Atmospheres—Their Generation and Use. William F. Barstow. *Industrial Heating*, v. 16, Apr. 1949, p. 614, 616, 618, 620, 622, 624, 699.

Development of controlled atmospheres, the chemical elements which must be considered in furnace atmospheres, their compounds and reactions. Five basic groups of atmosphere gas generators, their more outstanding characteristics, the types of atmospheres each generates, and the uses to which they are suited.

16A-39. Crucible Completes $3,200,000 Program at Spaulding Works. *Industrial Heating*, v. 16, Apr. 1949, p. 635-636, 638, 640, 642, 700, 702, 704.

Miscellaneous new furnace equipment which produces a wide range of cold-rolled alloy, stainless, and high-carbon-steel specialties, and the center of Crucible's special products manufacturing and development activities for the production of magnets, precision castings, cast alloy steels, and alloy welding rods.

16A-40. Rotary Heat Treating Method Reduces Floor Space Requirements and Provides Greater Operating Flexibility. Walter H. Holcroft and Edward C. Bayer. *Steel*, v. 124, May 2, 1949, p. 87-88, 137.

A controlled-atmosphere rotary heat treating furnace in operation in automotive plants. Furnace is suitable for carbonitriding, clean hardening, and deep case carburizing of small and medium-sized parts at temperatures up to 1700° F. Quench and wash are included.

16A-41. Un nouveau four électrique. Le four triphasé a arcs indirects Pechiney-Cartoux. (A New Electric Furnace. Three-Phase Furnace With Indirect Arc of the Pechiney-Cartoux Type.) Henri Cartoux. *Journal du Four Electrique et des Industries Electrochimiques*, v. 58, Jan.-Feb. 1949, p. 13-15.

Furnace has automatic control permitting easy operation with minimum man-hours and power involved. Such furnaces, designed for capacities between 600 kg. and 10 ton, are particularly adaptable for treatment of copper alloys, special and carbon steels, and different kinds of cast steels and irons. Construction details. (To be continued.)

16A-42. (Book.) **Waste-Heat Recovery From Industrial Furnaces.** 384 pages. 1948. Chapman & Hall, Ltd., 37 Essex Street, W.C. 2, London, England.

Introduction; eight papers based on a series presented at a recent Institute of Fuel Symposium; and a tabulation of heat-transfer data. Individual papers of direct metallurgical interest are abstracted separately.

16B—Ferrous

16B-50. Some Aspects of the Breakage of Coke. H. H. Lowry and Benjamin Epstein. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 3-23; discussion, p. 23-27.

Breakage mechanisms in general. It is indicated that conventional tests are not sufficiently informative and should be replaced by tests that give information at more than one point. Recommends use in future investigations of the effect of coke quality on blast-furnace performance of cokes having strength properties covering a wide range relative to errors of measurement. 17 ref.

16B-51. Construction of Firebrick Hearth and Operation of Jones and Laughlin Steel Corporation's No. 3 Blast Furnace at Aliquippa, Pennsylvania. Elmer H. Riddle. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Min-*

ing and Metallurgical Engineers, v. 7, 1948, p. 127-129; discussion, p. 129-130, 153-171.

16B-52. Carbon Hearths in Republic Blast Furnaces. Frank H. Janecek. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 130-138; discussion, p. 138-139, 153-171.

Design features.

16B-53. Use of Small and Large Blocks in Carbon Hearth Construction. William C. Bennett. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 139-145; discussion, p. 153-171.

Deals only with brick and block bottoms, giving experiences with three installations. Recommendations for type of construction. Carbon hearths were found to be satisfactory in every way, the blocks being considered superior to brick.

16B-54. Design of Carbon Hearth at Zenith Furnace. R. W. Thompson. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 146-148; discussion, p. 153-171.

Single-bottom, single-hearth-wall construction.

16B-55. Design of Carbon Hearth and Carbon Tapping Hole. H. E. McDonnell. *Proceedings, Blast Furnace, Coke Oven and Raw Materials Committee, Iron and Steel Division, American Institute of Mining and Metallurgical Engineers*, v. 7, 1948, p. 148-153; discussion, p. 153-171.

Performance experiences.

16B-56. Progress and Problems in Blast Furnace Design. C. G. Hogberg. *Blast Furnace and Steel Plant*, v. 37, Apr. 1949, p. 442-444. A condensation.

Practical and theoretical effects of furnace volume on blast-furnace performance.

16B-57. The Conversion to Oil Firing of the Open-Hearth Furnaces at Park Gate Works. D. F. Marshall and H. C. White. *Journal of the Iron and Steel Institute*, v. 161, Apr. 1949, p. 301-317.

Reasons for making the conversion and properties of the principal available fuels. Operating results: shop layout, type of charge, and furnace performance. Flow characteristics of three types of burner and details of the influence of roof temperature on the rate of furnace working. The life of the refractories used, and essentials for fully automatic furnace control.

16B-58. Designs Simple Type of Cupola Dust and Spark Arrestor. *Foundry*, v. 77, May 1949, p. 148.

Arrestor designed and used by the Pohlman Foundry Co.

16B-59. Fuel Oil in the Steel Industry. A. J. Fisher. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. 55-70; discussion, p. 70-71.

The diminishing supply and the problems it presents to the engineer. Various furnaces and their fuel consumption. Numerous tables on fuel-oil production and consumption.

16B-60. Series of Cylindrical Chamber Furnaces Reheat Pierced Tubes for Sizing at Gary Works of National Tube Co. *Industrial Heating*, v. 16, Apr. 1949, p. 586-592, 594, 596.

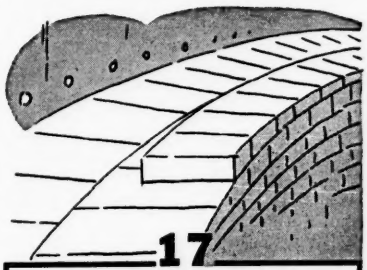
16B-61. Fuel Efficiency in the Blast Furnace. R. P. Towndrow. *Journal of the Institute of Fuel*, v. 22, Apr. 1949, p. 222-227.

Reviews developments during the present century in the manufacture of fuel for blast furnaces, the preparation of raw materials for smelting, and the design of furnace charging and blowing equipment. Thermal and chemical requirements of the furnace, and heat balance based on recent data for a large modern blast furnace.

16B-62. Heating, Forming and Bending. William A. Theil. *Industry and Welding*, v. 22, May 1949, p. 43-45, 73-75.

Use of the oxy-acetylene torch. Emphasis is on steel.

For additional annotations indexed in other sections, see: 2C-25; 18B-87



17 REFRACTORIES and FURNACE MATERIALS

17-32. Undersökningar av krossad kvarts fran Radanefors. (Investigations of Crushed Quartz From Radanefors.) Folke Sandford. *Jernkontorets Annaler*, v. 133, no. 3, 1949, p. 99-124.

The relationship between grain distribution and properties of silica refractories made from above quartz sand when used in acid openhearth furnaces was studied. The effect of grain distribution of the same sand when used in foundry molds for cast steel was also determined.

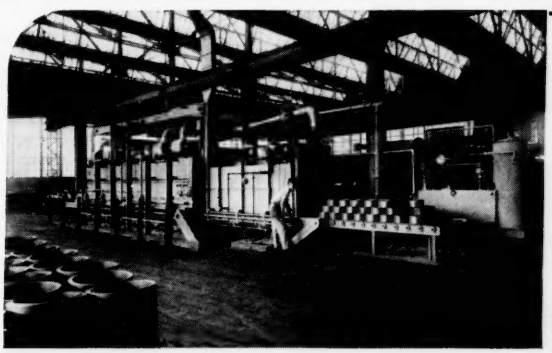
17-33. Some Effects of Zinc and Carbon Monoxide on Fire-Clay Refractories. R. F. Patrick and R. B. Sosman. *Journal of the American Ceramic Society*, v. 32, Apr. 1, 1949, p. 133-140.

No experimental proof could be obtained that zinc has any disintegrating action on blast-furnace fireclay brick. Zinc and zinc oxide, however, act as mild catalysts for the decomposition of CO to CO_2 and C, a reaction which has been proven, when catalyzed by iron, to be a prime cause of disintegration of fireclay brick. The carbon deposited by the reaction is crystalline graphite. 22 ref.

17-34. Etude sur les oxydes de fer dans la cuisson de la magnésite. (Study of Iron Oxides During Firing of Magnesite.) Otakar Quadrat and Miroslav Beranek. *Collection of Czechoslovak Chemical Communications*, v. 14, No. 1-2, 1949, p. 59-65.

Results of experimental investigation indicate that heating of magnesite ore with about 2.5% FeO in the form of $FeCO_3$ at 900-1000° C. in a nitrogen atmosphere effects oxidation of bivalent iron to ferric oxide. A well fired magnesite should not contain Fe_3O_4. For proper firing, all the iron should be in the trivalent form. Generally the remaining Fe_3O_4 is converted into calcium and magnesium ferrites by the action of calcium and magnesium oxides at about 1500° C.

17-35. Blast Furnace Brick Disintegration Test Equipment. J. A. Shea.



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A SIZE AND TYPE OF FURNACE FOR EVERY PROCESS PRODUCT OR PRODUCTION

Iron and Steel Engineer, v. 26, Apr. 1949, p. 121. A condensation.

Equipment consists of a gas-tight chamber to hold the test specimens, a suitable furnace, a pump for circulating CO over the specimens, absorption tubes to remove CO_2 and moisture, and a flow meter and pressure gage. Test procedure.

17-36. Properties and Performances of Open Hearth Bottoms. II. (Concluded.) Hobart N. Kraner. *Industrial Heating*, v. 16, Apr. 1949, p. 687-688, 690, 692.

Density and performance of the bottoms; and conclusions reached.

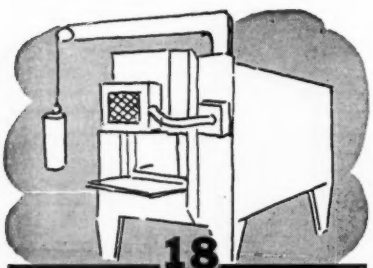
17-37. The Application of Super Refractories to Gas Fired Industrial Kilns and Furnaces. A. A. Turner and J. M. Smith. *American Gas Journal*, v. 170, May 1949, p. 40-41.

Basic types, forms available, and applications.

17-38. Evaluating Adherence of Blue Sheet-Iron Ground Coats. J. L. McLaughlin. *Journal of the American Ceramic Society*, v. 32, May 1, 1949, p. 166-170; *Better Enameling*, v. 20, May 1949, p. 6-7, 22-23, 26-27.

Reflectance measurements were used on sheet-iron plates tested by the drop-hammer impact machine. Results show good correlation with visual estimations of adherence of enamel on steel with and without nickel flashing.

For additional annotations indexed in other sections, see:
2C-25; 16B-51-52-53-54-55



18 HEAT TREATMENT

18A—General

18A-15. Effect of Contamination on Quenching Media. Howard E. Boyer. *Iron Age*, v. 163, May 5, 1949, p. 88-91, 100.

Results of a study of the influence of contamination on the efficiency of oil quenching media, in which the end-quench hardenability test was used in reverse. Effect of water contamination in oil, as compared with conventional oil and water quenching methods. Some notes on the influence of media temperature on quenching power.

18A-16. Problems in Heat Treating. Howard E. Boyer. *Steel Processing*, v. 35, Apr. 1949, p. 203-206, 215.

Causes and cures for cracking. (To be continued.)

18A-17. Liquid Salt Baths. I. J. A. McElgin. *Canadian Metals and Metallurgical Industries*, v. 12, Apr. 1949, p. 14-15, 37-42.

Applications to a wide variety of heat treating problems. (To be continued.)

18A-18. Steam Atmosphere Used to Heat Treat and Improve Surface Properties. F. L. Spangler. *Materials & Methods*, v. 29, May 1949, p. 56-58.

Methods by which many ferrous and nonferrous materials can be processed at temperatures up to 1000° F. in steam atmospheres to produce a thin, clean, and tenacious oxide film.

18B—Ferrous

18B-74. Effects of Temperature and Silicon Content on First Stage Annealing of Black-Heart Malleable Iron. J. E. Rehder. *American Foundrymen's Society*, Preprint 26, 1949, 5 pages; discussion, p. 5.

The relationship between Si content and time necessary for first-stage annealing. Plotting of the log. of Si content vs. log. of first-stage annealing time produces a straight line, whose slope is dependent upon carbon content. Experimental data on the relationship between temperature and time necessary for first-stage annealing falls on straight parallel lines when plotted as log. time vs. temperature. Application to commercial practice.

18B-75. Influence of Silicon Content on Critical Temperature Range During Slow Cooling of Black-Heart Malleable Iron. J. E. Rehder. *American Foundrymen's Society*, Preprint 27, 1949, 7 pages.

A series of white cast-iron bars were made from a charge containing approximately 2.55% C and 0.76-1.57% Si. After completion of first-stage annealing, upper and lower limits of the critical temperature range during cooling at 7° F. per hr. were determined. It is shown that the upper limit rises uniformly as Si content increases, and that the lower limit rises in a slower, less regular manner. Austenite, ferrite and graphite co-exist within the range in apparent equilibrium. The Fe-C-Si diagram at 2% Si published by Greiner, Marsh, and Stoughton appears to be more accurate than that of Boyles. Practical applications.

18B-76. Influence of Rate of Heating on First Stage Graphitization of White Cast Iron. Richard Schneidewind and D. J. Reese. *American Foundrymen's Society*, Preprint 37, 1949, 9 pages.

Sections of step bars poured from the same heat were annealed at 1700° F. Rates of heating were 6500, 350, and 150° F. per hr., respectively, between the temperatures of 1200 and 1700° F. It was found that the time necessary to complete first-stage graphitization decreased as the heating rate was decreased. The mechanism of graphitization.

18B-77. Facts and Fancies About Ammonia Carburizing. Sam Tour. *Metal Progress*, v. 55, Apr. 1949, p. 495-498.

Addition of ammonia to a prepared gas-carburizing atmosphere has been applied for parts which can tolerate no warpage during heat treatment yet need a hard surface with excellent wear resistance. Rather wide differences exist in published recommendations as well as in the details of installations. Areas where accurate studies are needed to supplant unsupported statements.

18B-78. Some Aspects of the Hardenability of Steels. H. J. French. *Metal Progress*, v. 55, Apr. 1949, p. 505-515.

Steels with the same end-quench hardness curves may have much different toughness, as measured by notch-bar tests at equal hardness and strength levels. This is true even though the steels may retain substantially equal amounts of austenite after the quench.

18B-79. Principles and Applications of Isothermal Heat-Treatment. J. M. Hodge. *SAE Quarterly Transactions*, v. 3, Apr. 1949, p. 267-273.

Previously abstracted from condensed version in *SAE Journal*, see item 18b-124, 1948.

18B-80. Precision Heat Treating Oil Well Sucker Rods. *Steel*, v. 124, Apr. 18, 1949, p. 85-86.

Sucker-rod requirements manufacturing facilities and heat-treating procedures.

18B-81. Heat Treatment of Welded Joints of High-Pressure Boiler Tubes. (In Russian.) V. G. Dolgikh. *Avtogennoe Delo* (Welding), Jan. 1949, p. 24-25.

The influence of different methods of heat treatment on the mechanical properties of welded joints in Cr-Mo steel boiler tubes.

18B-82. Surface Hardening of Wheel Rims by the Oxyacetylene Flame. (In Russian.) S. V. Begun. *Avtogennoe Delo* (Welding), Jan. 1949, p. 26.

Apparatus and procedure.

18B-83. Structural Steels; The Hardening Operation in Practical Heat Treatment. (Concluded.) Quintin C. McMillan. *Iron and Steel*, v. 22, Apr. 1949, p. 117-119.

Experimental data on several British structural steels. Conclusions concerning preferred heat treating schedules.

18B-84. Lathe Bed Ways Hardened by Induction Heating. Fred W. Vogel. *Modern Machine Shop*, v. 21, May 1949, p. 170-172, 174, 176.

Equipment and procedures.

18B-85. Practical Pointers on Steel Treating. Part V. W. R. Bennett. *Modern Machine Shop*, v. 21, May 1949, p. 182-184, 186, 188, 190, 192, 194, 196, 198.

Quenching, hardening carbon-steel milling cutters, and heating and quenching hot forge drop dies.

18B-86. Untersuchungen uber die Zwischenstufenvergutung verschieden legierter Stähle. (Research on Intermediate-Stage Annealing of Different Alloy Steels.) Wilhelm Bischof. *Archiv fur das Eisenhuttenwesen*, v. 20, Jan.-Feb. 1949, p. 13-18.

S-curves of different Cr, Mn, V, Mo, W, Cu, and C steels were established by determining their structures and hardnesses at the beginning and end of the isothermal austenite transformation. Effects of intermediate-stage and ordinary annealing are compared by correlating respective notch-impact strengths and hardnesses. Intermediate-stage annealing was found to have a favorable effect on vanadium steels.

18B-87. The Basic Principles of Carburizing. II. E. Barber. *British Steelmaker*, v. 15, Apr. 1949, p. 182-185.

Recommended procedures. Various types of carburizing furnaces. (To be continued.)

18B-88. Selective Surface Hardening With High-Temperature Flames. Charles H. Wick. *Machinery*, v. 55, May 1949, p. 154-160.

How exacting metallurgical specifications and close dimensional tolerances can be maintained, and results consistently duplicated, by selective surface hardening with the flame-spinning method.

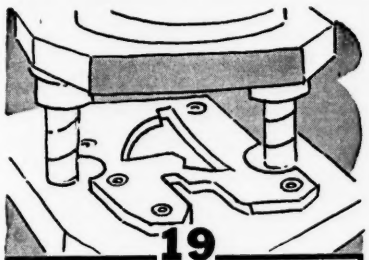
18C—Nonferrous

18C-5. "Hy-Therm" Copper—An Improved Conductor. L. F. Hickernell, A. A. Jones, and C. J. Snyder. *Electrical Engineering*, v. 68, May 1949, p. 402. Digest of "Hy-Therm Copper—An Improved Overhead-Line Conductor," to be published in *AIEE Transactions*, v. 68, 1949.

Annealing characteristics of hard drawn copper wire as affected by: chemical composition; heat and time

—with and without tension; intermittent heating; and manufacturing technique.

For additional annotations indexed in other sections, see:
2B-133; 3B-79-104; 3D-31; 16A-40; 21B-22; 23B-19; 24B-20



19 WORKING

19A—General

19A-103. Researches Into the Deformation of Metals by Cold Rolling. Hugh Ford. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 39, 1948, p. 115-143; discussion, p. 153-163.

Results of a large number of experiments on an experimental cold rolling mill. The experimental technique. Two methods of determining yield stress—one depending on a tensile test, the other on a compression test. The principal theories of rolling in relation to the experimental results. A new method of rapid calculation of rolling schedules, simpler than Orowan's exact method, yet applicable when rolling with strip tension shows that there is an approximate relationship between roll force and corresponding energy of deformation. 17 ref.

19A-104. The Calculation of Roll Force and Torque in Cold Strip Rolling With Tensions. D. R. Bland and Hugh Ford. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 39, 1948, p. 144-153; discussion, p. 153-163.

From an approximate theory, equations are derived for roll force and torque with and without front and back tensions applied to the strip. Where tensions are applied, calculations for each pass take about an hour; without tensions, and using curves given in this paper, they can be carried out in 10 min. Accuracy is within about 15%. Energy relationships in rolling.

19A-105. Various Types of Safety Devices Available for Power Presses. Francis A. Westbrook. *Modern Industrial Press,* v. 11, Apr. 1949, p. 6, 8, 56-61.

19A-106. Step-By-Step Press Operations in Metal Stamping at Northern Stamping & Mfg. Co. Howard E. Jackson. *Modern Industrial Press,* v. 11, Apr. 1949, p. 26, 30, 32, 54.

Miscellaneous small-piece operations, jewelry, souvenir spoons.

19A-107. Precision Press Work Emphasized at United Air Lines' Maintenance Base. J. Delamar Harrell. *Modern Industrial Press,* v. 11, Apr. 1949, p. 50, 52.

19A-108. Punch Press Safety Device. T. E. Tyler. *Machinery,* v. 55, Apr. 1949, p. 180.

Device consists of a sleeve that surrounds the punch in operation, thus permitting the operator to place his hands close to the tool without danger. The sleeve also acts as a stripper. It is used when piercing holes in flat materials. The holes may be round, square, or irregular in shape.

19A-109. Coining Die With Automatic Feed. *Machinery* (London), v. 74, Apr. 7, 1949, p. 448-449.

A coining die capable of forming 3600 washers per hour.

19A-110. Progressive Die for Two Similar Parts. Albert Maier. *Machinery* (London), v. 74, Apr. 7, 1949, p. 455.

Arrangement said to avoid certain disadvantages of die for the same purpose described by "F.S." in the Feb. 24 issue.

19A-111. Plastic Flow in Forming and Drawing Metals. C. L. Altenburger. *Steel,* v. 124, Apr. 18, 1949, p. 88-92, 94.

Relationship of die contours to metal characteristics and the advantages and disadvantages of common tests used in estimating the drawability of steel and other metals.

19A-112. Precision Switches Guard Progressive Die. P. R. Enzler. *American Machinist,* v. 93, Apr. 21, 1949, p. 86-88.

Automatic protection equipment for stopping machining when stock feeds improperly.

19A-113. Press-Room Standards. *American Machinist,* v. 93, Apr. 21, 1949, p. 93-108.

Standards developed by Automotive Joint Industry Conference for single and double-action presses.

19A-114. Stress Peening. John C. Straub and Don May Jr. *Iron Age,* v. 163, Apr. 21, 1949, p. 66-70.

New shot-peening technique in which peening takes place simultaneously with static stressing in the same direction as the stress

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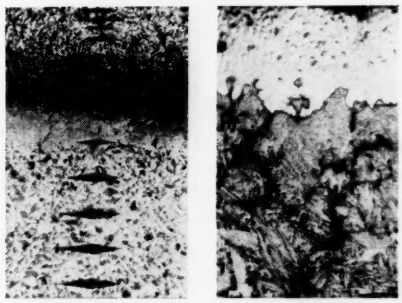

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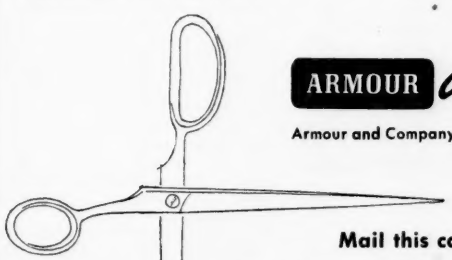

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to be sustained in service. This can be done with different shaped pieces. Comparative mechanical-test data on SAE 9260 steel, and theory of the effect.

19A-115. The Problem of the Interaction of Tools for Mechanical Working With Plastically Deformed Bodies. (In Russian.) I. M. Pavlov. *Izvestiya Akademii Nauk SSSR, Otdelenie Tekhnicheskikh Nauk* (Bulletin of the Academy of Sciences of the USSR, Section of Technical Sciences), Jan. 1949, p. 85-99.

Critically analyzes modern theory concerning action of the tool in machining and metal-forming operations; on the basis of Timoshenko's theory, the possibility of application of Hook's generalized law. Proposed equations interpreted for different variables.

19A-116. Improved Flying Shear Drive. J. Raymond Erbe. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. 74-77; discussion, p. 77-78.

Uses a single motor directly connected to the shear, eliminating some of the usual maintenance problems.

19A-117. The Design of Dies for Wire-Drawing; Influence of Die-Shape on Deformation Energy and Friction Losses. Erich Siebel, Nikolaus Ludwig, and Paul Melchior. *Wire Industry*, v. 16, Apr. 1949, p. 339-341. Translated and condensed from *Werkstatt und Betrieb*, v. 81, July 1948, p. 177-180.

Believed by the reviewers to be the first serious attempt to utilize experimental facts compiled by investigators of all nations to establish standards for the die shape of sintered carbide dies. Develops such standards by theoretical, mathematical analysis.

19A-118. Design for Impact. *Western Machinery and Steel World*, v. 40, Apr. 1949, p. 78-80.

Specially designed, 3000-lb. forging hammer and its installation.

19A-119. Air-Operated Jigs and Fixtures. *Machinery* (London), v. 74, Apr. 21, 1949, p. 503-509.

Some interesting applications of press tools at the Barnet Instruments, Ltd., makers of all types of pressure gages.

19A-120. An Analysis of Blanking Die Designs. Part II. C. W. Hinman. *Modern Machine Shop*, v. 21, May 1949, p. 128-130, 132, 134, 136, 138, 140, 142.

Important factors which must be considered in the design of compound blanking dies and selection of die sets.

19A-121. Wire Drawing Lubricants. Charles P. Orr. *Wire and Wire Products*, v. 24, May 1949, p. 407-410, 448-451.

Fundamental differences between the above and true lubricants used on bearing surfaces. Coatings used in the drawing of wire to neutralize acid carried over from pickling, to carry the lubricant, etc. Various types of drawing lubricants, their properties and applicabilities.

19A-122. A New Theory of the Plastic Deformation in Wire-Drawing. R. Hill and S. J. Tupper. *Wire and Wire Products*, v. 24, May 1949, p. 412-417, 443-445.

Previously abstracted from *Journal of the Iron and Steel Institute*, item 19a-195, 1948.

19A-123. Heating, Forming and Bending by the Oxy-acetylene Process. William A. Thiel. *Welding Journal*, v. 28, May 1949, p. 472-473.

19A-124. Mechanism of the Rolling Process. *Metal Progress*, v. 55, May 1949, p. 714, 716, 718.

A critical summary of "Fundamental Investigations on the Hot and Cold Rolling of Metals to Sheet and Strip, With Special Reference to Aluminum, Wrought Aluminum Alloys, Electrolytic Lead, and Steels," Otto Emicke and K.-H. Lucas, *Zeitschrift fur Metallkunde*, v. 34, 1942, p. 25-38, 49-58. The steels were low-carbon types containing 15% Ni and 5% Al, respectively.

19A-125. Designing Tools for Multi-Slide Machines. P. E. McKeith. *Machinery*, v. 55, May 1949, p. 145-151.

Stampings previously requiring operations on as many as ten separate presses can be completely finished on one multi-slide machine. Modern multi-slide machines combine horizontal presses, generally equipped with progressive dies, and a four-slide forming unit. Piercing, blanking, trimming, swaging, embossing, cutting off, and various forming operations can be performed simultaneously or in any desired sequence to produce a completely formed part, or several parts, at each stroke of the machine. Successive steps in production of typical pieces.

19A-126. Controlling Temperature in Hot Metal-Working Operations. Edwin F. Mosthaf. *Machinery*, v. 55, May 1949, p. 180-181.

System in which pressure is applied to the work by dies operated through an automatically controlled air circuit. The air circuit is interconnected with a photo-electric temperature-control unit and a source of electrical power for heating the work.

19A-127. Some Factors in Carbide Die Design. George Eglinton. *Tool Engineer*, v. 22, May 1949, p. 24-28.

19A-128. Stretch-Wrap Forming at NAA. Alexander McSurely. *Aviation Week*, v. 50, May 16, 1949, p. 40-41.

Use for high-speed aircraft.

19A-129. (Book.) **Arbeitsverfahren und Betriebsmittel.** (Production Processes and Methods.) Oskar Gonner. 176 pages. Carl Hanser Verlag, Munich, Germany. 8.20 DM.

A number of methods for manufacture of pipes and tubular hollow parts. Its special merit lies in drawing attention to obsolete practices and in giving full consideration to modern methods. Emphasis is on thin-walled tubes (0.5 to 2 mm.). The various types of conical tubes, bends, distributors, and other complex shapes manufactured by fabrication from sheet metal are fully described. (From review in *Engineers' Digest*, Mar. 1949.)

19B—Ferrous

19B-68. Production of Mild Steel Rings. *Machinery* (London), v. 74, Apr. 7, 1949, p. 445. Translated from *Technische Rundschau*, v. 40, Dec. 24, 1943, p. 29.

Flat mild steel rings of 13⅜ in. external and 11¾ in. internal diam. and 3/16 in. thick were produced, with practically no waste, from strip material of 1 by 3/16 in. section by winding it onto a mandrel.

19B-69. Some Reflections on the Investment Casting Process. D. F. B. Tedds. *Foundry Trade Journal*, v. 86, Mar. 31, 1949, p. 279-282; Apr. 7, 1949, p. 315-317.

Advantages and disadvantages of various methods for carrying out the process. Position taken to date by British industry.

19B-70. Modern Methods & Machines Keep Chevrolet Cross Member Job at Peak Production. P. D. Aird. *Modern Industrial Press*, v. 11, Apr. 1949, p. 13-14, 18, 22, 54.

Blanking-press operation.

19B-71. "Integrated Department" Practice in Fabrication at American Stove. Gerald E. Stedman. *Modern Industrial Press*, v. 11, Apr. 1949, p. 36, 38, 40, 52.

Press and welding operations.

19B-72. Hollow Metal Doors—One of Many Metal Specialties Produced at Dahlstrom Metallic Door Co. of Jamestown, N. Y. Walter Rudolph. *Modern Industrial Press*, v. 11, Apr. 1949, p. 42, 44, 46, 48.

Press operations.

19B-73. Making Windscreen Wiper Equipment; Methods Employed by Trico-Folberth, Ltd., Brentford, Middlesex. *Machinery* (London), v. 74, Apr. 7, 1949, p. 431-436.

Forming and machining operations.

19B-74. Bending Heavy Bars and Structural Shapes on Bulldozers. *Machinery* (London), v. 74, Apr. 7, 1949, p. 437-439.

Hydraulically-operated bulldozers for bending bars, tubes, angle-iron, and channels, of thick section.

19B-75. Looping and Repeating on Merchant Mills. W. J. Barry. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. 110-113; discussion, p. 113-115.

Hand looping was replaced by completely mechanized repeating on the 10 in. mill at the Lebanon plant of Bethlehem Steel Co. Diagrams of parts.

19B-76. Carnegie-Illinois Steel Corp. Modernizes Cold-Reduction Facilities at Gary. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. 122-123.

Capacity for production of tinplate and sheet steel was increased by extensive additions of new equipment and revision and replacement of existing facilities.

19B-77. Press Operations Produce Tricky Part. L. A. Young, Jr. *American Machinist*, v. 93, May 5, 1949, p. 88-89.

Solution of problem of low-cost mass production of steel retainer cap for the Thompson Roto-Cap, a device for positive rotation of engine valves while in operation. Cold stamping overcame obstacles of shape and tolerance after other methods of manufacture proved too costly.

19B-78. Die Ermittlung der Breitenzunahme beim Warmwalzen von Stahl auf glatter Walzbahn. (Determining Lateral Expansion in Hot-Rolling of Steel on Smooth Rolling Mills.) Werner Lueg. *Archiv fur das Eisenhuttenwesen*, v. 20, Jan.-Feb. 1949, p. 59-68.

Reduces the formulas developed by several authorities to a series of nomograms as an aid to the rolling-mill operator. 12 ref.

19B-79. Drop Forgings: Some Aspects of Die Life. H. J. Merchant. *Metal Treatment and Drop Forgings*, v. 16, Spring 1949, p. 3-11.

Modes of failure, effect of design, material specification, tooling, and forging factors.

19B-80. Die Sinking for Drop Forging. Part II. Die Room Equipment. John Mueller. *Steel Processing*, v. 35, Apr. 1949, p. 196-199.

Die block handling as related to die-room layout. (To be continued.)

19B-81. Heavy Forgings; Production for Marine Purposes. R. C. Benson. *Iron and Steel*, v. 22, Apr. 1949, p. 145-148; May 1949, p. 181-184.

Dimensional, shape and weight limitations of the various types.

19B-82. Feeder and Heater Speed Magnet Forming. Henry Orth. *American Machinist*, v. 93, May 19, 1949, p. 119.

Equipment and procedure. An electronic heating unit powers the induction coil.

19B-83. Air Press Trims Segment Bevel Gears. Paul Bludau. *American Machinist*, v. 93, May 19, 1949, p. 122.

Tilted fixture for a standard pneumatic arbor press which permits cutting one flare from gear with each stroke of the press.

19B-84. Straightening Shafts. *Iron Age*, v. 163, May 12, 1949, p. 100.

Use of hydraulic press for straightening steel forgings on which pinions are subsequently cut.

19C—Nonferrous

19C-12. Influence of Mechanical Deformation on the Variation of Electrical Resistance in a Longitudinal Magnetic Field (Thompson's Galvano-Magnetic Effect) in Ni_2Mn Alloy. (In Russian.) R. G. Annaev. *Doklady Akademii Nauk SSSR* (Reports of the Academy of Sciences of the USSR), new ser., v. 64, Jan. 1, 1949, p. 45-47.

Thompson's galvano-magnetic effect was investigated from the point of view of its dependence on elastic and plastic deformation in the range from weak field to saturation state. 12 ref.

19C-13. Continuous Lead-Extrusion Machine for Electric Cables. *Engineering,* v. 167, Apr. 8, 1949, p. 319-321, 324.

Above equipment made by a British firm.

19C-14. An Engineering, Metallurgical and Cost-Price Guide for Brass and Bronze Forgings. H. C. Ward. *Iron Age,* v. 163, May 12, 1949, p. 78-82.

Cu-base parts requiring a dense, uniform structure and a high-grade surface finish can often be produced economically by forging. Inherent advantages of forgings, engineering and metallurgical factors involved, and a general cost guide applicable to the average forged part.

19D—Light Metals

19D-32. Designing of "Trouble-Free" Dies. Part XCII. Suitable Presses for Drawing Sheet Aluminum. C. W. Hinman. *Modern Industrial Press,* v. 11, Apr. 1949, p. 24, 48.

19D-33. Aluminum Wire. *Light Metals,* v. 12, Apr. 1949, p. 203-215.

Concludes report of conference on Al-wire manufacture. Papers condensed in this installment deal with heat-treatment practice (D. C. G. Lees); with wire-drawing machines; and with wire-drawing dies (both by N. Davidson).

19D-34. Blockaufnehmer (Rezipienten) von Strangpressen fur Leichtmetalle. (Chambers for Light-Metal Extrusion Presses.) F. Nawroth. *Archiv fur Metallkunde,* v. 3, Jan. 1949, p. 23-27.

Materials and design, and systems of heating the chambers to any desired temperature. Properties of different metals and alloys.

19D-35. Apparition de cornes dans l'emboutissage de l'aluminium et de ses alliages. ("Ear" Formation in Deep-Drawing Operations on Aluminum and Its Alloys.) Raymond Chevigny. *Revue de l'Aluminium,* v. 26, Mar. 1949, p. 79-87.

Ears are troublesome deformations of the external edges of pressed or spun parts; they are caused by anisotropy of the mechanical properties of the metal in relation to the direction of rolling. With Al and its alloys four different types of deformation occur. Effects of impurities and methods of minimizing ear formation by proper rolling and annealing schedules.

19D-36. Aluminum Wire. Section III. Wiredrawing Machines; Wiredrawing Dies. N. Davidson. **Lubrication in Aluminium Wiredrawing.** A. L. H. Perry. *Wire and Wire Products,* v. 24, May 1949, p. 418-423, 446; discussion, p. 421, 446-448.

Section three of a series of lectures.

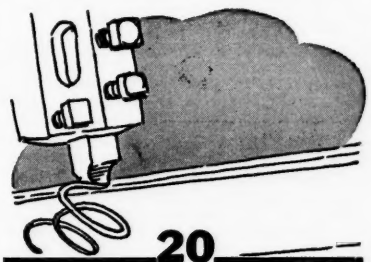
19D-37. Drawing and Spinning of Aluminum Alloys. *Machinery,* v. 55, May 1949, p. 170-176. Condensed from paper by E. G. Kort.

The preliminary annealing operation, giving recommendations for the various alloys; equipment and design of tools for drawing; equipment for spinning; and lubricants for drawing and spinning.

19D-38. Cutting Loads in Punch Press Tools. XIII. J. W. Lengbridge. *Tool Engineer,* v. 22, May 1949, p. 37-42.

Theory and practice of pressing aluminum, including tool penetration and shear, and the shaving (smoothing) of a pre-cut edge by removal of a small amount of metal. Experimental results obtained in a study of the mechanism of die cutting of Al under different conditions of clearances. Alloys tested were Alcan 2S-O, 2S-H, and 17S-T. Drawing lubricants, including lubrication of lithographed stock. (To be concluded.)

For additional annotations indexed in other sections, see:
3B-104; 14B-58; 21B-22



20 MACHINING and MACHINABILITY

20A—General

20A-182. Tooling Chucking Automatics. *Screw Machine Engineering,* v. 10, Apr. 1949, p. 22-25.

Dimensional requirements and machine tool setups for a forged yoke of complex design.

20A-183. Single Job, Three Case Histories, Illustrate Modern Tooling Methods. *Screw Machine Engineering,* v. 10, Apr. 1949, p. 32-36.

Complete tooling of a specific screw-machine product. Procedure includes tooling on three different multiple-spindle bar machines of the same make. Production time and added operations in each instance.

20A-184. Turret Lathe Practice. E. L. Murray. *Screw Machine Engineering,* v. 10, Apr. 1949, p. 38-42.

Methods by which turning, facing, and boring operations can be accomplished on the turret lathe.

20A-185. Pitfalls to Avoid in Tooling Screw Machines. Part Ten. Noel Brindle. *Screw Machine Engineering,* v. 10, Apr. 1949, p. 45-49.

Types of problems encountered in choosing a suitable method for manufacturing parts on the automatic screw machine. Three typical examples.

20A-186. Distribution of Heat Generated in Drilling. A. O. Schmidt and J. R. Roubik. *Transactions of the American Society of Mechanical Engineers,* v. 71, Apr. 1949, p. 245-248; discussion, p. 248-252.

Object of investigation was to determine the amount of heat which goes into the workpiece, chips, and drill at different cutting speeds and feeds. A tubular test bar of extruded Dowmetal was used as the workpiece, thus making the cutting action of the drill similar to that of a single-point tool. The total heat, the heat in the chips, and the heat in the drill were measured separately in a calorimeter.

20A-187. Grinding Fine-Pitch Gears. A. S. Beam. *Machinery* (London), v. 74, Apr. 7, 1949, p. 443-445. A condensation.

20A-188. Automatic Chuckers Feature High Production and Efficiency. Gus Carlson. *Iron Age,* v. 163, Apr. 21, 1949, p. 78-83.

Advantages in machining a wide variety of work.

20A-189. Multiple-Unit Castings Reduce Loading Time. Chester S. Ricker. *American Machinist,* v. 93, Apr. 21, 1949, p. 84-85.

Application to cut total machining time per piece. A group of identical units are cast as one piece, machined, then the connecting metal sawed out by a gang saw.

20A-190. Practical Ideas. *American Machinist,* v. 93, Apr. 21, 1949, p. 111-116.

Compact dividing head positions small work (C. Jaikens); thread-rolling on shaper (E. C. Schlenker); pneumatic tool lift on planing machine reduces wear, work time, improves quality and accuracy (R. J. Henkes); tapping nuts on turret lathe (T. W. V. Morgan); reciprocating stone on lathe for lapping and superfinishing (Aaron H. Shum); fixture for grinding front-clearance angles on toolbits (Federico Strasser); machining and grinding segmented ring by use of adapters (F. Forquer); tailstock-mounted fixture for turning external radii (John Homewood); fixture plate holds small parts on grinding table (J. R. Paquin); piloted drill-press tool chamfers shaft ends (Roger Isetts); and other miscellaneous shop hints.

20A-191. Entwicklungslinien im Werkzeugmaschinenbau. (Machine-Tool Developments.) Rolf Lambertz. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 91, Feb. 15, 1949, p. 73-81. 38 ref.

20A-192. Air Age Machine Shop. A. R. Frank. *Western Machinery and Steel World,* v. 40, Apr. 1949, p. 75-77.

Equipment and procedures.

20A-193. Duplicating Lathe Cuts Machine Time. *Western Machinery and Steel World,* v. 40, Apr. 1949, p. 96.

Its use.

20A-194. Electrical Drives for Machine Tools. Georg Schlesinger. *Machinery* (London), v. 74, Apr. 21, 1949, p. 510-513.

Varied requirements and need for standardization. Suggests a motor design based on interchangeable parts to meet contradictory requirements.

20A-195. Mass Production Techniques for Building Special Application Machines. Gerald Eldridge Stedman. *Production Engineering & Management,* v. 23, May 1949, p. 41-44.

Various machine tools and procedures used in manufacture of machines for producing crown corks, thread and lug caps, and other types of metal closures for liquid containers.

20A-196. Work-Holding Methods for Jigs and Fixtures. Robert Mawson. *Tool & Die Journal,* v. 15, May 1949, p. 46-48, 50.

Typical set-ups. Need for finished surface on the workpiece.

20A-197. Broaching "Christmas Tree" Slots in Jet Engine Rotors. *Tool & Die Journal,* v. 15, May 1949, p. 64-65.

Special equipment.

20A-198. Applying the Vertical Shaper to Tooling and Production. *Tool & Die Journal,* v. 15, May 1949, p. 60-62.

20A-199. Some Machine Tool Control Circuits. L. Hesse. *Electrical Manufacturing,* v. 43, May 1949, p. 110-115.

Three examples demonstrate effective combination of air and hydraulic circuits with electrical controls to simplify mechanical design,

reduce maintenance, and increase flexibility of functions.

20A-200. Modern Equipment at Work. *Modern Machine Shop,* v. 21, May 1949, p. 202-204, 206, 208, 210.

"American Duplex Surface Broaching Machine Used for Broaching Diesel Bearing Supports"; "Sheffield Multichek Used to Check Piston Dimensions"; "Swiss Precision Jig Borer in Use at Baker Brothers Plant"; "Snyder Multiple Operation Machine Used for Automotive Assemblies".

20A-201. Ideas From Readers. *Modern Machine Shop,* v. 21, May 1949, p. 214-216, 218, 220.

"Fixture Designed for Boring Spherical Holes", Aaron H. Shum; "Auxiliary Control for Shear", Clarence Reynolds; "Protractor on Emery Grinder Rest Aids in Angle Grinding", A. H. Waychoff; and "A Method of Checking Pitch Diameter Runout", E. P. McKitrick.

20A-202. Unit Tooling; Developments in the Wharton Universal System. *Aircraft Production,* v. 11, May 1949, p. 174-176.

The June 1946 issue described the Wharton universal system of jig and fixture construction which is based on the assembly of standardized units or elements. Subsequent modifications.

20A-203. Talented Tooling. *American Machinist,* v. 93, May 5, 1949, p. 94-95.

Tunnel broach machines at high speed; boring-machine turret positions valve parts; indexing plate clamps sprockets for spline broaching; and cradle loads billiard balls for grinding.

20A-204. How to Choose and Use Files. Grant Loader. *American Machinist,* v. 93, May 5, 1949, p. 101-108.

Types of metalworking files, how to select the right kind of file for the job, how to use files correctly, and how to take care of them.

20A-205. Practical Ideas. *American Machinist,* v. 93, May 5, 1949, p. 119-124.

Includes the following: safety devices on hand miller permit semi-automatic cycle (Glenn E. Shopbell); inexpensive toolholder increases cutter height (Roger Isetts); spring plunger aligns flat-head thumbscrews (Kinson Kwauk); soldered bushings locate punch holes in die blocks (Paul E. Wasser); making torque-converter blades from extrusions by unusual diagrammed technique (Chester S. Ricker); checking custom-made micrometers for parts up to 70-in. diam. (Robert A. McCloud); drum-and-cable attachment for lathe permits taper turning (Wendell H. White); grooving tool mounts off-center cutter (L. J. Visser); cutting longitudinal slots in short tubing on the lathe (Aaron H. Shum); angle-plate setup for shaping grinding wheels (Arnold Gamalsky); centering device locates shaft in steadyrest (Samuel C. Smith); wire guide facilitates spring winding (Lowell F. Stull).

20A-206. Rack Slotting in a Rise and Fall Miller. *Iron Age,* v. 163, May 5, 1949, p. 87.

Milling procedure for tabular racks on IBM electric typewriters. These require straight slots on one face of the bar and arc-shaped ones on the other.

20A-207. Broaching Typewriter Parts. *Iron Age,* v. 163, May 5, 1949, p. 97.

Steel carriage rails with a V-groove rolled into one side and Al die-cast key-lever bearings are among the parts for IBM electric typewriters that are processed in horizontal broaching machines.

20A-208. Wear Proofing Centerless Grinder Rests. *Iron Age,* v. 163, May 5, 1949, p. 100.

Use of brazed-on strips of cemented carbide along the length of the rest is reported to increase the life of these parts more than 350 times.

20A-209. Drilling Bush Attached to Portable Drills. M. Reichner. *Engineers' Digest,* v. 10, Mar. 1949, p. 100. Translated and condensed from *Werkstatt und Betrieb,* v. 81, June 1948, p. 163.

Drilling small holes with a portable drill often results in drill breakage. A simple jig which can be fitted to electrical and other portable drills and has been proved to prevent frequent drill breakage.

20A-210. Electrolytic Tool Sharpening. S. E. Noshov. *Engineers' Digest,* v. 10, Mar. 1949, p. 95-97. Translated and condensed from *Stanki i Instrument* (Machine Tools and Instruments), v. 19, Oct. 1948, p. 20-22.

Previously abstracted from orinal source, item 20A-55, 1949.

20A-211. Multiple Spindle Drill Heads. H. E. Scheibe. *Engineers' Digest,* v. 10, Apr. 1949, p. 129-132. Translated and condensed from *Werkstatt und Betrieb,* v. 81, Nov. 1948, p. 309-315.

20A-212. Helical Gears Cut on "Solid Table" Machines. No. I. Distribution and Amount of Errors. S. A. Couling. *Engineer,* v. 187, Apr. 22, 1949, p. 430-432.

Explanation based on theory and experiment of the fact that a relatively high number of teeth in the master worm wheel of a hobbing machine without the creep mechanism is necessary in order to produce cut gears which are free from "hobber" noise. Inaccuracies of the index drive; relationship of worm-wheel error to number of teeth on the cut gear; and amplitude of imposed worm-wheel error. The latter was measured experimentally.

20A-213. Producing a Square Hole on a Multiple-Spindle Automatic. *Machinery* (London), v. 74, Apr. 28, 1949, p. 545-546.

Ingenious tooling set-up.

20A-214. Drilling and Tapping Machines Mounted on Ways to Increase Work Range. F. J. Austin. *Machinery,* v. 55, May 1949, p. 152-153.

Unusual set-ups: horizontal drilling and tapping machine on ways constructed along one side of long floor plates enables drilling, tapping, and facing operations on Diesel-engine blocks to be conveniently performed; and portable drilling and tapping machine is used for producing 80 holes around a large drying kiln.

20A-215. Selection of Carbide Grades and Recommended Cutting Speeds. *Machinery,* v. 55, May 1949, p. 162-164. Condensed from "Carboloy Tool Manual," to be published by Carboloy Co.

Information on grades of carbide to be employed in machining various types of metal and on recommended speeds.

20A-216. Toolpost Grinders in Tool-Room and Maintenance Work. J. F. Fischer. *Machinery,* v. 55, May 1949, p. 165-167.

Last of three articles describing various applications of toolpost grinders.

20A-217. Tool Engineering Ideas. *Machinery,* v. 55, May 1949, p. 183-186.

"Fixture for Holding Thin-Walled Castings in a Lathe", Frank J. Peragine; "Fixture for Multiple Broaching of Tapered Grooves", Harold E. Murphy; "Quick-Acting Drill Jig", Robert Mawson; and "Double-Action Clamping Device", F. Server.

20A-218. Abrasive Cut-Off Wheels: Their Selection and Use. B. G. Ebbeson. *Tool Engineer,* v. 22, May 1949, p. 17-20.

Recommendations applicable to a wide variety of metallic and nonmetallic materials.

20A-219. Cutting Tools and Fixtures. (Concluded.) A. E. Rylander. *Tool Engineer,* v. 22, May 1949, p. 43-44.

With comments on drilling, tapping, and boring the part shown in Installment No. 8.

20A-220. Gadgets. *Tool Engineer,* v. 22, May 1949, p. 47.

"Method for Angular Milling", Robert Mawson; "Vise Jaw With Graduated Scale", C. W. Frank; and "To Preserve Layout Lines", Federico Strasser.

20A-221. Skiving Solves Production Problems on Long Contoured Part. *Screw Machine Engineering,* v. 10, May 1949, p. 22-25.

20A-222. Turret Lathe Practice. E. L. Murray. *Screw Machine Engineering,* v. 10, May 1949, p. 32-37.

Application to various jobs.

20A-223. Longitudinal Turning Attachment Aids in Completing Intricate Part. *Screw Machine Engineering,* v. 10, May 1949, p. 44-48.

20A-224. When and How to Use Carbide Insert Cutting Tools. J. S. Gillespie. *Iron Age,* v. 163, May 12, 1949, p. 84-89.

How tools and toolholders should be designed, applied and maintained, with particular emphasis on holder design and grinding of the inserts.

20A-225. Cutting Hydraulic Pump Gears. *Iron Age,* v. 163, May 12, 1949, p. 94-95.

Process which solves a number of difficult manufacturing problems not encountered in production of conventional gearing, and also reduces production time many fold. Basis of the process is the Shear-Speed gear cutting machine which employs form tools rather than generating tools and cuts all teeth of the pump gear simultaneously.

20A-226. Quick-Acting Fixtures Simplify Machining. Fred A. Worley. *American Machinist,* v. 93, May 19, 1949, p. 96-97.

Fixture and operations on pump and valve body castings.

20A-227. Practical Ideas. *American Machinist,* v. 93, May 19, 1949, p. 126-130.

Includes the following: grown-up boring-bar holder acts as simple turret (Allan B. Nixon); cam-checking setup gives dial-indicator accuracy (Gerhard Wenke); clamp lever forces work onto countersinking tool (E. C. Schlenker); sleeve templet aids in accurate recessing (H. Moore); light holder speeds dressing (Joseph Z. Madaras); shim cutter gages widths (J. A. Raught); tension rod and indicator gage broaching force (A. Vetsch); special angle plate features adjustable bar (Allan B. Nixon); drill stop controls hole depth to four thousandths (N. Bownass); soft mandrel centers parts (Fred H. Lingenfelder); and other miscellaneous shop hints.

20A-228. (Book.) **Carboloy Tool Manual.** 190 pages. Carboloy Co., Inc., 11155 E. 8-Mile Dr., Detroit 32, Mich. 50c; free to supervisory personnel.

Design, manufacture, and application of single-point carbide tools. Divided into 10 sections on tool design; chip-breaker design; selection of grades and recommended speeds; brazing; tool grinding; chip-breaker grinding; application of tools; trouble-shooting; tool control and method selection; and inspection.

20A-229. (Book.) **Engineering Materials and Processes.** L. H. Hancock. 214 pages. Sir Isaac Pitman & Sons, Ltd.,

Parker St., Kingsway, London, W.C. 2, England. 15s. net.

Arranged in five parts devoted to materials, machine tools, processes requiring heat, testing of materials, and jigs and fixtures. Written for students in the third year of mechanical engineering.

20A-230. (Book.) **Toleranzen und Lehren.** (Tolerances and Gages.) Paul Leinweber. Springer-Verlag, Jebenstrasse 1, Berlin-Charlottenberg 2, Germany. 8.40 marks.

Intended primarily for the machine designer. Individual chapters deal with the various classes of fits. The types of gages, their proper use in shops and assembly rooms, and methods of their construction. Examples follow the theoretical discussion of gages of every variety.

20B—Ferrous

20B-47. Hot Milling: Milling High Strength Alloys at Elevated Temperatures. A. O. Schmidt. *Iron Age,* v. 163, Apr. 28, 1948, p. 66-70.

Experimental work involves heating the work to be machined to 1000-1500° F. and machining at those temperatures. Definite reductions in power requirements, faster cutting speeds and feeds, and good tool life. The technique of hot milling, methods of application of heat to the workpiece, cutting speeds and feeds, and various other results of extensive investigations. Data are confined to various high-strength steels.

20B-48. Machining Axles at Ford at Speeds up to 830 sfpm. Thomas E. Lloyd. *Iron Age,* v. 163, Apr. 28, 1948, p. 72-77.

Ford Motor Co. has raised cutting speeds to 830 surface ft. per min. with good tool life in machining some details of a hardened steel axle. Still higher speeds are being tested. Machine and tooling details and operating data.

20B-49. High Production Turning of Rough Forgings. *Automotive Industries,* v. 100, May 1, 1949, p. 46, 67.

Two examples of above applied to alloy-steel automotive parts.

20B-50. A Conical Boring Head. S. N. Filonenko. *Engineers' Digest,* v. 10, Jan. 1949, p. 25-26. Translated and condensed from *Stanki i Instrument* (Machine Tools and Instruments), No. 4, 1948, p. 22-23.

Design and advantages.

20B-51. Steel Castings Carry the Load. H. M. Stoneham. *Western Machinery and Steel World,* v. 40, Apr. 1949, p. 62-65, 85.

Production of cast-steel truck-trailer axle assemblies. Machine-shop and foundry procedures.

20B-52. The Production of Engines for the Standard Vanguard. *Machinery* (London), v. 74, Apr. 14, 1949, p. 467-477.

Machine-shop equipment and procedures for British automobile.

20B-53. Crankshaft Grinding With Multiple Wheels. *Machinery* (London), v. 74, Apr. 21, 1949, p. 520-521.

Procedure.

20B-54. New Departure's Sandusky Plant—An Epoch in Sixty Years of Progress. *Production Engineering & Management,* v. 23, May 1949, p. 49-56.

Equipment and procedures for production of precision-made ball bearings. Inspection, materials handling, and hardening procedures.

20B-55. Cylinder Machining Time Cut More Than Half. Robert F. Stucker and Raymond Fogarty. *Modern Machine Shop,* v. 21, May 1949, p. 146-148, 150.

The machining of locomotive cylinders in the South Louisville terminal shops of the L. & N. R. R. is cited as an example of savings in both set-up and machining time made possible when a single machine is employed to perform a variety of operations.

20B-56. NATCO Holeway Cylinder Block Processing Machine. R. A. Schafer. *Machine and Tool Blue Book,* v. 45, May 1949, p. 103-119.

Machine which drills, reams, chamfers, and taps 56 cylinder blocks per hour. Its station-by-station operation; indexing, locating, and clamping circuit; tapping units.

20B-57. "Automation." N. L. Bean. *Mechanical Engineering,* v. 71, May 1949, p. 389-390, 394.

As applied to the production of valve-guide bushings. From the first machine operation right through all operations including inspection, practically all work is carried on automatically. Impact of this revolutionary system on industrial production as a whole.

20B-58. Scroll Chuck Parts Need Versatile Tooling. George Kluter. *American Machinist,* v. 93, May 5, 1949, p. 98-100.

Tooling for these precision parts.

20B-59. Special Cutters Mill Filleted Keyways. W. F. Burchfield. *American Machinist,* v. 93, May 5, 1949, p. 117.

Double the life is secured from marine shafts if sharp, internal corners are avoided.

20B-60. Indexing Fixtures and Automatic Cycling Cut Production Costs on Dynaflow Parts. Herbert Chase. *Steel,* v. 124, May 9, 1949, p. 98-101.

20B-61. Friction-Sawing Facts and Figures. H. J. Chamberland. *Engineers' Digest,* v. 10, Jan. 1949, p. 23-25.

Friction-cutting of various steels by the band-saw method. Production data and saw-control factors.

20B-62. Machining Motor Car Cylinder Heads and Bearing Caps. *Machinery* (London), v. 74, Apr. 28, 1949, p. 539-545.

Equipment and procedures used by British firm.

20B-63. Chucking Automatic Combines Machining, Assembly Operations. *Screw Machine Engineering,* v. 10, May 1949, p. 40-43.

As applied to a typical example: a cast-iron starter housing which, in addition to general machining operations, requires that a bushing be pressed into the front end and bored out in relation to both the face and diameter of the rear tenon.

20B-64. Roll Machining Time Cut Two-Thirds by Template Controlled Lathe. *Steel,* v. 124, May 16, 1949, p. 96.

20B-65. Friction Bandsawing. *American Machinist,* v. 93, May 19, 1949, p. 141, 143.

Transforms high surface speed of the disk periphery to the edge of a rapidly moving bandsaw blade. Advantages and applications.

20B-66. (Book.) **Jigs, Tools and Fixtures. Ed. 4.** Philip Gates. 215 pages. The Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey, England. 17s. 6d.

Deals with drill jigs, milling fixtures, chucks and turning equipment, cutters, screwing equipment, gages, press tools and cams. Use of magnetic and pneumatic fixtures and materials used in jigs, tools and fixtures. Design aspects and standardization. Representative examples.

20C—Nonferrous

20C-12. Production of Long Brass Tube Successful With Combined Carbide, High Speed Tools. Frank Ungleich. *Screw Machine Engineering,* v. 10, Apr. 1949, p. 27-30.

Fabrication procedure of the above tube.

20C-13. Broaching—A Practical Method for Machining Die Castings. M. E. Engebretson. *Die Castings,* v. 7, May 1949, p. 44-47, 58-59, 62-63.

Methods and tools, and some case histories. Compares broaching with other machining methods.

20D—Light Metals

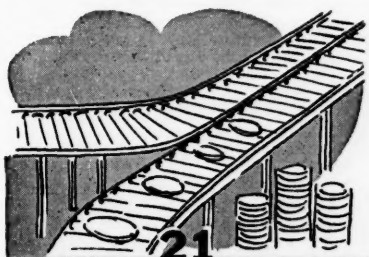
20D-12. Machining Slipper-Type Piston for High Compression Engine. Joseph Geschelin. *Automotive Industries,* v. 100, May 1, 1949, p. 40-41, 78.

Set-ups for machining piston for the 1949 Cadillac V-8 engine. A major problem is that conventional chucking would be sufficient to cause distortion of the skirt. Added to this are the special requirements of the new high-compression engine which demand still closer attention to fine tolerances.

20D-13. Milling Aircraft Wing Skins. T. E. Lloyd. *Iron Age,* v. 163, May 5, 1949, p. 78-80.

Methods and equipment used by North American in production of air foils for its F-86 fighter by contour milling the wing skins. Other possible methods under consideration by the Air Forces.

For additional annotations indexed in other sections, see: 12-86; 19B-73; 23C-34



21 MISCELLANEOUS FABRICATION

21A—General

21A-31. Special Motors for Special Jobs. *Western Machinery and Steel World,* v. 40, Apr. 1949, p. 82-84.

Production including foundry, finishing, coil-winding, press, and machine-shop operations.

21A-32. Fracturing Connecting Rods Assures Perfect Alignment. *Iron Age,* v. 163, May 5, 1949, p. 81.

"Perfect alignment" rods are made by an unusual method. The rods are forged with a round crank-pin hole, machined and heat treated in one piece. Then the cap is fractured from the rod. The fractured faces of the cap and rod make perfect mating surfaces when re-assembled. The method has been used on hardened-steel and Al-bronze rods for various applications.

21A-33. Assembling Metal Parts by Shrink Fitting. C. Deschars. *Materials & Methods,* v. 29, May 1949, p. 64-67.

Using liquid nitrogen as the cooling medium. Typical set-ups, and nitrogen-consumption and metal-contraction data for a wide variety of metals and alloys.

21B—Ferrous

21B-21. Stainless Steel Restaurant Equipment. *Sheet Metal Worker,* v. 40, Apr. 1949, p. 35-38.

Fabrication and assembly.

21B-22. The Manufacture of Hoes in Brazil. Joao Gustavo Haenel. *Steel Processing,* v. 35, Apr. 1949, p. 187-190.

Standard requirements and methods of manufacture. Heat treating, forming, and application of hard-metal cutting edges. Structure of bond between hard and soft metals is illustrated.

21B-23. Charts for Press-Fit Forces. I-III. Tyler G. Hicks. *American Machinist,* v. 93, May 5, 1949, p. 135, 137, 139.

Charts for steel shafts to steel hubs and to cast-iron hubs.

21B-24. Portsmouth Steel Corporation. *Wire and Wire Products,* v. 24, May 1949, p. 424, 445-446.

Modernized mill for all phases of steel manufacture, rolling and wire operations.

21B-25. Sheet Steel Processing at Carnegie's Gary Sheet & Tin Mill. *Better Enameling,* v. 20, May 1949, p. 8-12.

21B-26. (Book.) **Fabrication of Lukens Clad Steels.** Leonard W. Williams. 89 pages. 1948. Lukens Steel Co., 399 Lukens Building, Coatesville, Pa.

The various Lukens clad steels and their properties. Fabrication procedures used in their manufacture, including handling, heat treating, hot and cold working, shearing, bending, punching, rolling, machining, flame cutting, welding, finishing. Appendix gives tests and specifications.

21D—Light Metals

21D-5. Aluminum Bus Manufacturing. Walter Rudolph. *Light Metal Age,* v. 7, Apr. 1949, p. 8-9, 16.

21D-6. The Nord Norécrin. James Hay Stevens. *Aircraft Engineering,* v. 21, Apr. 1949, p. 117-121.

Manufacturing methods for French lightweight airplane.

21D-7. Hermes IV and Hastings. Part III. Front and Rear Fuselage-Sections; Trolley- and Skin-Covering Fixture Stages; Centre Fuselage; Wing. S. C. Poulsen. *Aircraft Production,* v. 11, May 1949, p. 149-156.

Production of above components of British planes. (To be concluded.)

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22A—General

22A-95. Rivet Flexibility and Load Diffusion. E. H. Mansfield. *Aircraft Engineering,* v. 21, Apr. 1949, p. 96-98, 116.

Mathematical analysis shows how strength and stiffness of rivets affect structure. Relative efficiency of rivets and spot welds. Three cases are worked out.

22A-96. All-Weld-Metal Tensile Tests; Elimination of Variables for Quality Control. E. Flintham. *Welding,* v. 17, Apr. 1949, p. 160-164.

The author feels that tests required by British Standards are not satisfactory for quality control. Suggests new procedures which would eliminate variables as far as possible.

22A-97. Railroad Car Welding. C. R. Strutz. *Welding Journal,* v. 28, Apr. 1949, p. 329-334.

Applications of submerged-melt and inert-gas welding to stainless steel and nonferrous-metal welding.

22A-98. Open-Circuit Voltage of A.-C. Arc Welders. S. Oestreicher. *Welding Journal,* v. 28, Apr. 1949, p. 356-357.

Influence on design and performance, using several simplified relationships.

22A-99. Designing for Welding. Part IV. Wallace A. Stanley. *Welding Journal,* v. 28, Apr. 1949, p. 371-372.

Recommendations for projection welding. Some applications. (To be continued.)

22A-100. Safety Precautions in Arc Welding. W. W. Reddie. *Steel,* v. 124, Apr. 25, 1949, p. 86-90.

Practices in construction, installation, and operation of equipment which can help to eliminate damage to workers and property.

22A-101. Remarks on the Article of Acting Member of the Academy of Science of the USSR, N. N. Dobrokhotov: "Interaction of Elements and Oxides in the Welding Bath During Welding of Metals". (In Russian.) M. M. Timofeev. *Avtogennoe Delo* (Welding), Jan. 1949, p. 29-30.

Particular reference to the possibility of the existence of thermodynamic equilibrium during electric-arc welding and the influence of replacing manganous oxide by calcium oxide in the flux on its oxidizing effect.

22A-102. The Design and Fabrication of Welded Structures Subjected to Repeated Loading. Part II. R. Weck. *Welder,* v. 18, Jan.-Mar. 1949, p. 15-19.

Notch effects. Methods for determining stress concentrations. Multi-axial stresses in the vicinity of a notch.

22A-103. Hartlöten unter Schutzgas. (Hard Soldering Under a Protective Gas.) Karl-August Lohausen. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 91, Feb. 15, 1949, p. 89-93.

A simple method of joining individual metallic parts; different types of electrically heated soldering furnaces and various types of protective gas. Examples of successful use.

22A-104. What Welding Means to America. Part Four. Transportation Equipment. T. B. Jefferson. *Welding Engineer,* v. 34, May 1949, p. 36-38.

Another of a series based on a survey made to determine the extent and kind of welding used in various industries.

22A-105. Trade Names of Copper Electrodes and Comparable AWS Designations. *Welding Engineer,* v. 34, May 1949, p. 49.

A table.

22A-106. New Maintenance System Trims Welder Downtime 80 Per Cent. William J. Scanlon. *Factory Management and Maintenance,* v. 107, May 1949, p. 106-108.

Procedure for inspection and repair of welders which involves a card-index system, inspection and minor repairs in the field, written reports and a careful follow-up and stocking of spare parts.

22A-107. Smooth Regulation of Spot Welding Sets by Means of a Choke in Their Secondary Circuit. A. Z. Blitstein. *Engineers' Digest,* v. 10, Mar. 1949, p. 91-92. Translated and condensed from *Avtogennoe Delo* (Welding), Oct. 1947, p. 6-8.

With theoretical derivations.

22A-108. Quelques aspects de la métallurgie du soudage par résistance. (Some Aspects of the Metallurgy of Resistance Welding.) A. Leroy. *Soudure et Techniques Connexes,* v. 3, Jan.-Feb. 1949, p. 33-45.

Metallurgical phenomena were investigated. Work was done on different types of steel and light alloys. Photomicrographs of seams, welded by different methods, proves the author's theoretical assumptions.

22A-109. Shooting Fasteners. I. E. Madsen. *Fasteners,* v. 5, No. 4, [1949], p. 10-13.

Powder-cartridge rivet-driving tools and their use.

22A-110. Production Processes: Their Influence on Design. Part XLIII. Welding, General Considerations. Roger W. Bolz. *Machine Design,* v. 21, May 1949, p. 119-125.

The various welding methods, indicating principles of selection. Design principles. AWS Summary of Standard Welding Symbols. (Series to be concluded.)

22A-111. Welding Nomenclature and Definitions. W. L. Warner. *Welding Journal,* v. 28, May 1949, p. 427-434.

Some of the basic concepts involved in the formulation of the new "Standard Welding Terms and Their Definitions" which have just been approved. Reasoning leading to the formulation of these terms.

22A-112. Welding Applications in Automotive Construction. John F. Randall. *Welding Journal,* v. 28, May 1949, p. 435-442.

Solution of some high speed production problems by use of specially designed welding equipment.

22A-113. How to Qualify Your Welders. Simon A. Greenberg. *Welding Journal,* v. 28, May 1949, p. 459-461.

Test requirements.

22A-114. The Strength of Silver Alloy Brazed Joints. C. D. Coxe and A. M. Setapen. *Welding Journal,* v. 28, May 1949, p. 462-466.

Strength is influenced by the brazing alloy, its thickness, strength of the metal joined, flux inclusions, and mechanical characteristics of the associated structure. Impact, fatigue, and high-temperature properties of brazed joints.

22A-115. Designing for Welding. Part V. Wallace A. Stanley. *Welding Journal,* v. 28, May 1949, p. 470-471.

Right and wrong designs for projection welding. (To be continued.)

22A-116. Here's How Welding Research and Development Pay Off at the Glenn L. Martin Co. Louis Barrett and Floyd Chitty. *Industry and Welding,* v. 22, May 1949, p. 48-50, 52, 55, 76.

Equipment and procedures, showing improvements on specific jobs discovered by means of research.

22A-117. Metal Coatings Improve Solder Flow on Steel and Brass. David Wallace. *Materials & Methods,* v. 29, May 1949, p. 60-63.

Experience and tests with a number of hot-dipped and electroplated coatings show that plated lead-tin alloy provides best solderability with rosin flux. Solder spread on various coated brass surfaces. Results after 6 and 9 months aging as well as immediately after plating.

22A-118. Design for Resistance Welding. E. J. Del Vecchio. *Tool Engineer,* v. 22, May 1949, p. 21-23.

First of a series on resistance-welding applications. (To be continued.)

22B—Ferrous

22B-136. Factors Influencing the Weldability of High Tensile Alloy Steels.

and a New Weld Cracking Test. P. L. J. Leder. *Institution of Mechanical Engineers, Proceedings,* v. 159, War Emergency Issue No. 40, 1948, p. 173-186; discussion, p. 186-190.

See abstract of condensed version in *Engineering,* item 22b-214, 1948.

22B-137. How to Weld Pipe. *Linde Tips,* v. 28, Apr. 1949, p. 29-33.

Recommended procedures for steel pipe.

22B-138. Investigation of Welded Ship Construction. J. Lyell Wilson. *Welding Journal,* v. 28, Apr. 1949, p. 319-328.

Briefly evaluates some research of the Ship Structure Committee. General design, details of construction, fabrication, and materials. 21 ref.

22B-139. The Metallurgy of Arc Welding in Steel. R. D. Stout. *Welding Journal,* v. 28, Apr. 1949, p. 335-352.

Some basic metallurgical principles involved in arc welding. The fusion process, weld solidification, weld shrinkage in hot and cold forming, heat treatment, and physical properties vs. microstructure.

22B-140. Welded Units for a Vehicular Tunnel. Clyde M. Leavitt. *Welding Journal,* v. 28, Apr. 1949, p. 353-356.

Fabrication and field erection of tunnel sections. Similarity with ship construction.

22B-141. Techniques for Auto Body and Fender Brazing. Carl E. Jacobs. *Welding Journal,* v. 28, Apr. 1949, p. 365-367.

New procedures that are said to cut costs, broaden field of application, and permit inexpensive repairs which formerly were impractical.

22B-142. Hints for Hard Facing. H. B. Gilson. *Welding Journal,* v. 28, Apr. 1949, p. 368-369.

Recommendations for cast iron.

22B-143. Badly Fractured Cast-Iron Gear Box Repaired. Donn Boring. *Welding Journal,* v. 28, Apr. 1949, p. 369.

Repair with Ampco-Trode 10 aluminum-bronze electrodes.

22B-144. Development of Weldable High-Strength Steels. C. E. Sims and H. M. Banta. *Welding Journal,* v. 28, Apr. 1949, p. 178s-192s.

Underbead cracking in steel which is caused by release of hydrogen concentrations. It was found that quenched and untempered low-carbon martensite is quite ductile. The influence of composition on underbead cracking and strength.

22B-145. 164 Welds in 32 Seconds. *Steel,* v. 124, Apr. 18, 1949, p. 87.

Automatic multiple-spot welding machine used in the fabrication of steel homes.

22B-146. Welding Increases Bobbin Capacity. *Iron Age,* v. 163, Apr. 28, 1948, p. 71.

Method used to increase bobbin size to handle 8 oz. of thread instead of 3½ oz., using the old rolls and hangers.

22B-147. Verschleissfestigkeit und Wirtschaftlichkeit von Auftragsschweissungen. (Wear Resistance and Economy of Hard Facing Materials.) Hans Wahl. *Metalloberfläche,* v. 2, Aug. 1948, p. 169-170.

The problem of the best hard-facing material for a given type of wear, also the type that is most desirable from the cost standpoint. A testing machine.

22B-148. Experimental Welding of Rail-Joints in India by Thermalite Process. Phiroz Meherji Dalal. *Science & Engineering,* v. 2, Jan. 1949, p. 7-11.

Method and its advantages. Composition of the "Thermalite" compound.

22B-149. Special Electrodes for Depositing Cutting Edges on Cutting Tools. V. V. Danilevsky. *Engineers' Digest,* v. 10, Jan. 1949, p. 26. Translated and condensed from *Avtogennoe Delo* (Welding), Feb. 1948, p. 26-27.

Previously abstracted from original item 22b-146, 1948.

22B-150. Some Aspects of the Welding of Cast Iron. *Welder,* v. 18, Jan.-Mar. 1949, p. 2-5.

Preheating, cooling, peening, welding procedure, applications, light-stress cracks, high-stress fractures, and electrodes.

22B-151. Repairs to Marine Diesel Engines in Shanghai. *Welder,* v. 18, Jan.-Mar. 1949, p. 6.

22B-152. Welded Pressure Vessels. Nicol Gross. *Welder,* v. 18, Jan.-Mar. 1949, p. 8-11.

Stress conditions and production of various types. X-ray and mechanical tests required.

22B-153. Hard Facing Hammers Subject to Impact and Abrasion. *Welder,* v. 18, Jan.-Mar. 1949, p. 12-13.

Reinforcement of hammers of the "Flextooth" metal-turnings crushers by the electric welding process.

22B-154. Furnace Brazing Small Steel Parts. II. H. M. Webber. *Industrial Heating,* v. 16, Apr. 1949, p. 600, 602, 604, 606, 608, 610, 744, 746.

Application to magneto governor housing; magneto impulse coupling plate; and fuel-injection-pump part. Equipment used for furnace brazing and its operation.

22B-155. Mill Housings; Successful Repairs by Thermit Welding. *Iron and Steel,* v. 22, Apr. 1949, p. 124-126.

22B-156. Arc Welding Offers Progress in Machinery Manufacture and Structural Building. C. G. Herbruck. *Steel Processing,* v. 35, Apr. 1949, p. 191-195.

22B-157. New Life for Lumber Carriage Knees. Wilbur C. Smith. *Welding Engineer,* v. 34, May 1949, p. 21.

Binding and galling was resulting in field repairs and lost operating time. Bearing surfaces are now overlaid with aluminum bronze during manufacture.

22B-158. Thermit Welding Repairs a Cracked Stern Frame. Margaret Ralston. *Welding Engineer,* v. 34, May 1949, p. 26-27.

22B-159. 200-Ft Spans Field Welded. Henry W. Young. *Welding Engineer,* v. 34, May 1949, p. 28-29.

Fabrication of structural members for large transit shed.

22B-160. "Welding-Through" Joins Sheet Metal. H. E. Cable. *Welding Engineer,* v. 34, May 1949, p. 30-31.

Automatic hidden-arc welding of 20-gage flanged halves simplifies production of gastight radiation chambers for heating units. Welds are made through the flanges like spot welds at a speed of 120 in. per min.

22B-161. Welding on the Farm. Phil Glanzer. *Welding Engineer,* v. 34, May 1949, p. 32-33.

Miscellaneous repair applications.

22B-162. "Hot Welding" Steam Cylinders in Germany. John J. Christie. *Welding Engineer,* v. 34, May 1949, p. 39.

German method of arc welding in which a carbon mold is built about the work. The space left between the carbon plates is filled with weld metal by the metal-arc process.

22B-163. World's Largest Pipe Welder. Clyde B. Clason. *Welding Engineer,* v. 34, May 1949, p. 42, 44.

Pipe up to 16-in. diam. can be butt welded in continuous production in a new tube mill built for service in Argentina. The electrode wheels are 54 in. in diam. and weigh 2000 lb.

22B-164. Flame Shape-Cutting in Railroad Shop Operations. F. B. Rykoskey. *Railway Mechanical Engineer,* v. 123, May 1949, p. 253-255.

Flame cutting produces savings in duplicating parts, and flux-cutting eliminates clamping.

22B-165. Cam Shape Determines Contour of Gear Teeth. *Product Engineering,* v. 20, May 1949, p. 102.

Machine which automatically flame cuts gears and sprockets without the use of templets. A cam and pantograph arrangement controls the cutting motion. The cam determines the tooth contour. Adjustments are provided so that several hundred different tooth contours may be traced from any one of the 20 basic cams.

22B-166. Modern Welding Procedures in Building Motor Car Bodies. E. O. Courtemanche. *Machine and Tool Blue Book,* v. 45, May 1949, p. 121-122, 124, 126-132.

Progress toward more automatic equipment for welding. Procedure, equipment, and technique employed.

22B-167. Shift to AC Welders Saves Power. Fred B. Mead and F. V. Schilling. *Iron Age,* v. 163, May 5, 1949, p. 98-99.

By replacing 27 d.c. welders with a.c. welders, fabricator was able to realize its capital investment in 20 months from power savings alone.

22B-168. Furnace Brazing Improves Refrigerator Parts. Walt Rudolph. *American Machinist,* v. 93, May 5, 1949, p. 96-97.

Sound, gas-tight joints are produced, and substantial time savings effected in joining tubing to steel backplate.

22B-169. Mesure du retrait dans l'assemblage de poutrelles par soudure. (Determination of Contraction in Welded Structures.) H. Gerbeaux. *Soudure et Techniques Connexes,* v. 3, Jan.-Feb. 1949, p. 11-18, 45.

Stresses and deformations in soft-steel arc-welded structures as affected by different welding sequences. Method of investigation.

22B-170. Statische und dynamische Festigkeitsuntersuchungen an Pumktschweissverbindungen aus hochfesten Stahlfeinblechen. (Static and Dynamic Strength Tests of Spot-Welded Joints in Light-Gage Sheet Steel.) Viktor Hauk. *Archiv fur das Eisenhuttenwesen,* v. 20, Jan.-Feb. 1949, p. 41-51.

Optimum welding conditions for two different low-carbon steels by testing the static-strength properties of the sheets welded under different conditions. Photomicrographs show structures of the weld samples in the untreated and annealed states.

22B-171. Hardness and Wear Resistance—Hard Surfacing by Fusion Welding. Howard S. Avery. *"Engineering Laminates"* (John Wiley & Sons, 1949), p. 483-550.

Selection and application of hard-surfacing welding rods. Welding techniques mentioned briefly. Compositions; properties; structures, corrosion resistance; and methods for hard facing and for welding rod manufacture. Abrasion testing and abrasion resistances of numerous weld deposits. 40 ref.

22B-172. The Influence of Core Wire on the Characteristics of Low Carbon Steel Welding Electrodes. D. C. Martin, C. B. Voldrich, and P. J. Rieppel. *American Iron and Steel Institute,* Preprint, 1949, 62 pages.

Results of research done during 1946-1948, inclusive. Data are based on many hundreds of tests of core wires from various types of steel, and from various locations in the heat and in the ingot. Tests were made with bare-wire electrodes, and with covered wires representative of three widely used classes of low-carbon steel-covered electrodes. Various types of tests were made in all welding positions by several operators, and also with automatic welding machines.

22B-173. Flame-Cutting Stainless Steel by New Method. *Welding Journal*, v. 28, May 1949, p. 468.

Oxweld powder-cutting process proved to be a quick and efficient method to accurately cut holes in the curved side of a stainless-steel tank.

22B-174. How to Repair Grate Bars. F. C. Geibig. *Welding Journal*, v. 28, May 1949, p. 469-470.

Recommended procedures for welding repair.

22B-175. Mechanized Flame-Cutting Lengths of Pipe. A. H. Wilson. *Welding Journal*, v. 28, May 1949, p. 471-472.

Simple set-up.

22B-176. Resistance Welding at Work. *Welding Journal*, v. 28, May 1949, p. 474.

Application to production of motor housings.

22B-177. Stud Welding Cuts Plumbing Costs. *Welding Journal*, v. 28, May 1949, p. 475.

Use in installation of bathroom and kitchen plumbing fixtures.

22B-178. Effect of "Quench Time" on Weld Metal. Jay Bland. *Welding Journal*, v. 28, May 1949, p. 216s-226s.

Results of various postwelding quench times on the ductility of all-weld-metal tensile coupons prepared with Type E6011 electrodes. An attempt is made to explain the presence of fissures causing low ductilities in specimens quenched within 1-3 min. after welding. Some evidence for considering retained dissolved hydrogen to be the cause of fissure formation.

22B-179. Several Steel Forms Combined in Heavy-Duty Weldments. Kenneth Rose. *Materials & Methods*, v. 29, May 1949, p. 49-51.

Large diesel crankcases built up of steel forgings, plate, tubing, and bar stock. They are said to have advantages of light weight, lower cost, and longer service life.

22B-180. Are You Welding Light Gauge Tubing? C. E. Deig. *Industry and Welding*, v. 22, May 1949, p. 30-33, 69-73.

Procedures and equipment used in manufacture of gas refrigerators. Tubing used conforms roughly to SAE 1010 specification.

22B-181. Tips on Hardsurfacing. Part I. M. Riddibough. *Industry and Welding*, v. 22, May 1949, p. 34-35, 37-38, 40.

First installment covers design of the weld deposit. (To be continued.)

22B-182. Textile Mill Saves 50%. John L. Perry. *Industry and Welding*, v. 22, May 1949, p. 60.

35,000 cast-iron rolls were adapted to take larger bobbins by use of machinable welds.

22B-183. Fixturized Soldering Insures Handle Bars. James H. King. *American Machinist*, v. 93, May 19, 1949, p. 94-95.

Fixtures and procedures for silver-soldering the above.

22C—Nonferrous

22C-11. Shear Impact and Shear Tensile Properties of Adhesives. Irving Silver. *Modern Plastics*, v. 26, May 1949, p. 95-97, 136-138.

Previously abstracted from condensed version, item 22A-55, 1949.

22C-12. How to Evaluate Solder Efficiency. Clifford L. Barber. *American Machinist*, v. 93, May 5, 1949, p. 110-113.

Careful tests made under controlled conditions reveal interesting data on the efficiency of various alloys for soldering. Data for 22 compositions.

22C-13. The Welding of Pure Molybdenum. H. J. Nichols, K. B. Young, and M. J. Nolan. *Welding Journal*, v. 28, May 1949, p. 236s-239s.

Some preliminary results obtained in welding Mo of 99.9% purity, and the necessity of proper welding precautions. The pseudowelds obtained in molybdenum with common welding processes are quite brittle; reasons for this.

22D—Light Metals

22D-32. Soldering Aluminum. J. F. Whiting. *Canadian Metals and Metallurgical Industries*, v. 12, Apr. 1949, p. 22-23.

22D-33. Typewriter Parts Fixtured for Induction Brazing. *Iron Age*, v. 163, Apr. 28, 1948, p. 87.

Fixtures and procedures used to fabricate typewriter carriages from three steel stampings.

22D-34. Welding of Aluminum and Its Alloys. E. G. West. *Engineering*, v. 167, Apr. 8, 1949, p. 317-319; Apr. 15, 1949, p. 341-342.

The present status, with particular reference to investigations now under way by several associations concerned with welding research.

22D-35. Cyclotrons: Une curieuse utilisation du soudage par etincelage. (Cyclotrons: An Unusual Application of Flash Welding.) Henri Lebouteux and Maurice Victor. *Revue de l'Aluminium*, v. 26, Mar. 1949, p. 92-96.

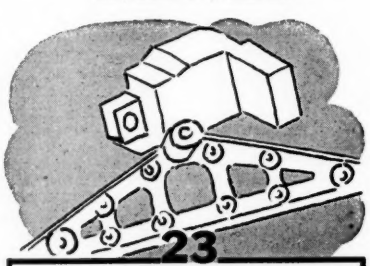
In the Rochester cyclotron, flat aluminum bars were flash welded into a strip of the desired length. For the McGill University and the Brookhaven Laboratory cyclotrons the same result was obtained by continuous extrusion of hollow shapes 1600 ft. long. Equipment and procedures.

22D-36. Supersonic Tinning of Aluminium Wires. *Machinery* (London), v. 74, Apr. 28, 1949, p. 546-547. Condensed from BIOS Report No. 1844.

Method developed by Trendelburg and Schofer in Germany of making soldered joints without flux.

For additional annotations indexed in other sections, see:

2B-145; **3B**-84; **6C**-25; **7D**-24; **9**-130; **12**-94; **14A**-64; **19B**-71; **21B**-22; **23D**-40; **24B**-26



23A—General

23A-9. Litho Ovens Speed Can Production. Arthur Q. Smith. *Industrial Gas*, v. 27, Apr. 1949, p. 3-5.

Gas-fired coating and lithographing drying ovens.

23A-10. Hard Facing: New Armor for Cold War on Costs. *Modern Industry*, v. 17, Apr. 15, 1949, p. 50-53.

Miscellaneous applications of improved methods for laying a hard metallic surface over a not-so-hard base metal.

23A-11. Pneumatic Sander Employs Magnesium Housing and Alloy Steel Working Parts, for Light Weight and High Capacity. C. N. Douglass. *Machine Design*, v. 21, May 1949, p. 103-106.

23A-12. Materials at Work. *Materials & Methods*, v. 29, May 1949, p. 68-70.

Welded aluminum cans; all-brass combination window; cored steel agitator blades; transparent plastic oil cup; flexible steel folding rule; plastic television cabinet; molded-on plastic handles; and nylon spray-gun valve.

23B—Ferrous

23B-19. Selection and Heat Treatment of Cutting Tools. Norman I. Stotz. *Metal Progress*, v. 55, Apr. 1949, p. 484-489.

Recommendations on how to avoid troubles in cutting tools arising from improper selection of type and careless heat treatment. Significance of hot hardness and relation of structure to performance.

23B-20. High-Speed Production of Metal Kinescopes. H. P. Steier and R. D. Faulkner. *Electronics*, v. 22, May 1949, p. 81-83.

New techniques employed in the manufacture of 16-in. and other television-receiver picture tubes which reduce their cost. Single-platform tilting tables have been replaced by a series of continuous settling belts. Metal used was selected on the basis of its glass-sealing properties. It is a modified high-Cr SAE 446 alloy.

23B-21. Glass-Lined Steel Equipment. O. I. Chormann. "Engineering Laminates" (John Wiley & Sons, 1949), p. 573-582.

Types of steel suitable, fabrication methods (forming, welding, and cleaning), chemical durability of the glasses used, and applications.

23B-22. (Book) **A History of Cast Iron in Architecture.** John Gloag and Derek Bridgwater. George Allen and Unwin, Ltd., 40, Museum-Street, London, W.C.1, England. 63s. net.

The history of cast iron as a material for the construction and decoration of buildings, with sidelights on the development of the iron industry and the use of iron as a material for engineering purposes. Illustrated with over 500 photographs and reproductions of drawings and six colored plates.

23C—Nonferrous

23C-30. Titanium: The New Metal. *Fortune*, v. 39, May 1949, p. 121-123.

Production methods, properties, and potentialities.

23C-31. Swinging Along. *Die Castings*, v. 7, May 1949, p. 20, 64.

Use of Zn-alloy die castings in outdoor swings, furniture, and playground equipment.

23C-32. 300 Miles to the Gallon. H. K. Barton. *Die Castings*, v. 7, May 1949, p. 23-24, 63.

French bicycle motor built almost entirely of zinc die castings.

23C-33. Worth Looking Into. *Die Castings*, v. 7, May 1949, p. 34-36, 65.

Die-cast base and frame for student microscope. Simple machining and finishing help reduce costs. Includes two Zn and two Al die castings.

23C-34. Recent Carbide Applications. *Tool & Die Journal*, v. 15, May 1949, p. 76, 78.

Use of the solid cemented-carbide boring bar, carbide milling cutters, all-purpose carbide bushings, carbide seaming rolls, and packaging wheel dressers.

23C-35. Metal Trace Elements in Agriculture: Manganese, Copper, Zinc, Boron, "Moly", Cobalt, Etc. Frank A. Gilbert. *Journal of Metals*, v. 1, sec. 1, May 1949, p. 8-11.

Twenty-five years ago, it was believed that only 10 elements were

essential for plant growth and 13 for animals. At least 6 more are now known to be important. Need for the trace elements, so called because of the minute amounts needed, first became evident because growth of certain crops was practically prevented in certain areas. Certain animal diseases were also found to be caused by mineral deficiency. Incorporation of these minerals in fertilizer and livestock feed is a new outlet for the metal-producing industries of importance from a tonnage standpoint.

23C-36. Nickel Alloys in Pulp and Paper Making. R. T. Barnes, Jr., and K. H. J. Clarke. *Paper Mill News*, v. 72, May 14, 1949, p. 26, 28, 30-32, 34.

Corrosion resistance and applications of the various types.

23D—Light Metals

23D-31. In Three Years Magnesium Designer & Fabricator Develops Sound Enterprise. W. B. Griffin. *Modern Metals*, v. 5, Apr. 1949, p. 19-23.

Varied military applications of magnesium.

23D-32. Magnesium Alloy Castings for Reducing Product Costs. R. F. Hauser. *Modern Metals*, v. 5, Apr. 1949, p. 25-27.

Properties, applications, and advantages, as well as some limitations.

23D-33. Progress Report: Magnesium Truck Bodies. *Modern Metals*, v. 5, Apr. 1949, p. 29-32.

23D-34. Magnesium Axle Development. *Modern Metals*, v. 5, Apr. 1949, p. 35.

Shuler Axle Co., Louisville, Ky., has developed an 18,000-lb. capacity trailer axle with Mg brake assembly and Mg hub. It is lighter than a conventional steel assembly (or even aluminum).

23D-35. Magnesium Tools for Builders. *Modern Metals*, v. 5, Apr. 1949, p. 37-38.

New light-weight tools for plasterers and bricklayers and their helpers.

23D-36. Light Alloys in Aircraft Construction. H. Sutton. *Engineering*, v. 167, Apr. 15, 1949, p. 357-359. Condensed from "Some Metallurgical Problems of Importance to Aircraft," *Journal of the Institute of Metals*, v. 75, Dec. 1948, p. 269-284.

Previously abstracted from original, item 23D-14, 1949.

23D-37. Bound to Get There. *Die Castings*, v. 7, May 1949, p. 18-19, 67.

How machining time on machine for putting steel bands on boxes has been reduced from 3.97 to 0.88 hr. by changing from malleable castings to aluminum die castings. Lifting and bending stresses are distributed evenly by proper section design and reinforcement of wear points by inserts.

23D-38. A Product That Clicks. *Die Castings*, v. 7, May 1949, p. 27-30, 69-70.

Use of Al die castings in press cameras.

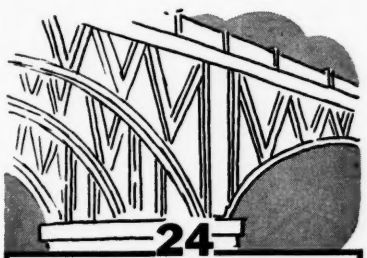
23D-39. Aluminum Therapy Conquers Silicosis. J. W. G. Hannon and Paul G. Bovard. *Mining Engineering*, v. 1, sec. 1, May 1949, p. 20-22.

History of Canadian medical research program which has resulted in the ability to make the statement of the title with confidence. Inhalation of Al dust at regular intervals prevents development of silicosis in a large majority of cases.

23D-40. Light-Alloy in the Petroleum Industry. *Light Metals*, v. 12, Apr. 1949, p. 196-202.

Possibilities of use in oil pipelines and accessory fittings. Comparative corrosion data for steel and Al alloys. Welding procedures. (To be continued.)

For additional annotations indexed in other sections, see: 3B-79-82-107; 3C-97; 3D-37; 24A-80; 24D-6



24A—General

24A-68. A New Approach to the Design of Dynamically Loaded Extension and Compression Springs. Curt I. Johnson. *Transactions of the American Society of Mechanical Engineers*, v. 71, Apr. 1949, p. 215-223; discussion, p. 223-226.

Formulas and derivations which permit straightforward solution of spring problems with minimum assumptions. It is based upon a new method of graphical representation of spring characteristics. A method of cataloging stock springs.

24A-69. Stress Investigations in Gas Turbine Discs and Blades. S. S. Manson. *SAE Quarterly Transactions*, v. 3, Apr. 1949, p. 229-239.

Results of an investigation to measure the operating temperatures in a disk of a typical gas turbine engine. Data used to determine operating stresses and their implications on disk bursting, rim cracking, and inner-region cooling. Temperature distributions and vibrational stresses in a typical gas-turbine engine. Vibration was present, excited mainly by nozzle vanes and combustion chambers.

24A-70. You Pick the Winner! Frank C. Cech. *Foundry*, v. 77, May 1949, p. 168-170, 172.

Some of the entries in the A.F.S. patternmaking contest.

24A-71. Improving Bolt Performance. Arthur R. Anderson. *Product Engineering*, v. 20, May 1949, p. 109-111.

Photoelastic investigation of stresses in bolts shows that stress concentration can be reduced significantly by modifying the contour between bolt head and bolt body, and by annular grooving. Stress patterns.

24A-72. Joining Sheet Metal Parts Without Fasteners. Erwin Rausch. *Product Engineering*, v. 20, May 1949, p. 122-123.

Various methods of attaching rods, tubing and sheet metal parts in permanent or temporary assemblies without using bolts, screws, or rivets.

24A-73. Pipe-Stress Analysis for Thermal Expansion. Simon W. Lewaren. *Oil and Gas Journal*, v. 47, May 5, 1949, p. 80, 82-84, 87-88.

Simple arithmetical and graphical method giving results well within allowable limits. Illustrates its use by several examples.

24A-74. Couplings for Built-up Crankshafts and Their Behavior Under Load. G. Simonetti. *Engineers' Digest*, v. 10, Apr. 1949, p. 133-134. Translated and condensed from *Tecnica Italiana*, v. 3, Sept.-Oct. 1948, p. 261-265.

When solid crankshafts are not possible, the sections must be joined by some type of coupling. Special type of coupling in which the flanged section fits completely within a recess in the web of normal thickness. This arrangement can be applied to any crankshaft type, so that an engine can be equipped either with a built-up or a solid crankshaft. Comparative stress analysis and static tests on this type and the usual type in a 12,000-hp. engine indicate that the new type is highly satisfactory.

24A-75. The Strength of Laminates and Sandwich Structural Elements. N. J. Hoff. "Engineering Laminates" (John Wiley & Sons, 1949), p. 6-88.

Fundamental, mathematical principles of stresses and strains; design of sandwich structures. 79 ref.

24A-76. Formularisation of Stress-Strain Curves; Application to Test Results on Certain Alloys. Doris Crowden. *Metal Treatment and Drop Forging*, v. 16, Spring 1949, p. 25-30, 37.

Method for the calculation of physical properties of certain alloys, exemplified by some magnesium-base alloys. Curves of the hyperbola type are considered. A subsequent article will deal with the parabola and ellipse. (To be continued.)

24A-77. Stress Distribution Near Reinforced Circular Hole Loaded by Pin. Samuel Levy and Frank C. Smith. *Journal of Research of the National Bureau of Standards*, v. 42, Apr. 1949, p. 397-404.

Theoretical analysis and comparison of theoretical with experimental results for a plate of sandwich construction.

24A-78. Rubber Bonded to Metal Rapidly Becoming a "Production Tool". William A. Keetch. *Steel*, v. 124, May 16, 1949, p. 82-85, 116.

A variety of applications of rubber-metal composites in engineering design.

24A-79. (Book) **Engineering Laminates.** Albert G. H. Dietz, editor. 797 pages. 1949. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y.

Consists of 22 chapters. Includes composites of essentially all one class of material such as wood or metal, composites of several widely different materials such as plastic or rubber and fabric, composites essentially the same density throughout, and composites of lightweight cores and denser stronger skins commonly referred to as sandwich structures. Decorative laminates and laminates in which the surface material is essentially only a protective coating are excluded. Individual chapters dealing with metallic or partly metallic laminates are abstracted separately.

24A-80. (Book) **A Metallurgical Study of German Aircraft Engine and Airframe Parts. Part II.** Charles A. Otto, editor. 110 pages. 1948. Kennedy Press, Ltd., 31 King St. West, Manchester, 3, and Bedford St., London, W.C.2, England. 10s, 6d.

The material is classified by parts; i.e., a chapter on crankshafts, one on valve springs, etc. Compositions and structures are described, and apparent methods of manufacture are indicated.

24B—Ferrous

24B-20. An Investigation of the Stress-Strain Diagram at Low Temperatures. E. M. Shevandin. *Engineers' Digest*, v. 10, Jan. 1949, p. 7-10. Translated and condensed from *Zavodskaya La-*

boratoriya (Factory Laboratory), v. 13, 1947, p. 858-870.

True-stress diagrams were obtained for eight steels by the usual method on a Gagarin press, with tensile-test specimens of normal shape. Low-temperature tests were made in a special tin vessel of tumbler shape with a thick flat bottom, possessing good thermal-insulation properties.

24B-21. Festigkeitsversuche an Eisenbahnwagen-Achsen als Grundlage fur deren Berechnung. (Strength-Tests of Railroad Car Axles as a Basis for Their Design.) E. Sperling. *Zeitschrift des Vereines Deutscher Ingenieure,* v. 91, Mar. 15, 1949, p. 134-136.

Forces acting on the axles during operation, their fatigue strength, and the notch effect at the hub and the angle formed by the wheel with the axle. New principles of design.

24B-22. Significant Strength of Steels in the Design of Machine Parts. II. Charles Lipson, G. C. Noll, and L. S. Clock. *Product Engineering,* v. 20, May 1949, p. 124-128.

Effects of cold working, surface hardening, and plating on the strength of materials used for machine parts. Relationship between fatigue strength and life expectancy in service, and a practical method of constructing diagrams for obtaining allowable stress values for any finite life.

24B-23. Laundry Machinery Redesigned for Welded Construction. Frank A. Gerlach. *Iron Age,* v. 163, May 5, 1949, p. 92-93.

Redesign of a dry-cleaning washer to permit use of welded-steel construction, which resulted in reduced manufacturing costs. Operating efficiency and appearance were improved and weight was reduced.

24B-24. Testing Track Bolts. R. P. Winton. *Fasteners,* v. 5, no. 4, [1949], p. 14-19.

Test data on various types and sizes of bolts used on railroad track. Purpose of work, which was done by an ASA subcommittee, was to standardize on a minimum number of sizes.

24B-25. Notes on Alloyed Irons and Steels. J. George H. Thompson, editor. *International Nickel Co.,* July 1948, 40 pages.

Questions and answers concerning troublesome design cases as they actually arose in practice. Purpose is to give the student of machine design some training in the selection of materials and in considerations involved in making such selection.

24B-26. Evaluation of Effect of Residual Stresses. T. W. Greene. *Welding Journal,* v. 28, May 1949, p. 193s-203s; discussion, p. 203s-204s.

Welded test plates with reproducible defects such as notches were tested in the as-welded state and with low-temperature stress relieving and with furnace stress relieving by bending at different temperatures. Either type of stress-relieving appears to give considerable assurance against premature failure.

24B-27. How to Detail and Inspect Parts for Bolted Assembly. M. F. Spotts. *American Machinist,* v. 93, May 19, 1949, p. 124-125.

Several typical examples.

24B-28. (Book) **Light Gage Steel Design Manual.** 77 pages. 1949. American Iron & Steel Institute, 350 Fifth Ave., New York, N. Y. $1.00.

Supplements the Institute's official "Specification for the Design of Light Gage Steel Structural Members" published in 1946. Includes tables of structural properties and other design information for basic sections. Design charts are given for light gage structural members in bending and under compression; and for effective design widths for load determination and deflection determination. Examples of practical design problems.

24B-29. (Book) **Theory of Modern Steel Structures. Vol. II. Statically Indeterminate Structures and Space Frames.** Rev. Ed. Linton E. Grinter. 312 pages. 1949. Macmillan Co., 60 Fifth Ave., New York 11, N. Y. $5.25.

Engineering design principles are illustrated by problems for the student. Chapters on analysis and design of indeterminate structures; framed structures in space; deflections of structures; classical methods of analysis of indeterminate structures; analysis of continuous frames by moment distribution; analysis of continuous frames by balancing end angle changes; influence lines and maximum moment curves for continuous, movable and long-span bridges; and analysis of arches and closed rings.

24D—Light Metals

24D-5. Design Light Metal Castings: Responsibilities of Metal Producers, Foundries, and Designers. George H. Found. *American Foundryman,* v. 15, Apr. 1949, p. 91-95.

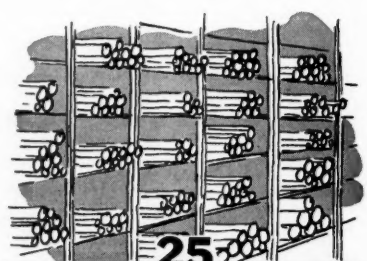
With special attention to Mg casting alloys. Mechanical properties as affected by different factors. 12 ref.

24D-6. Aluminium Alloys in Building; General Design Considerations for Roof Structures. W. C. Devereux. *Metal Industry,* v. 74, Apr. 15, 1949, p. 283-285; Apr. 22, 1949, p. 311-313.

Design, erection, and testing procedures.

For additional annotations indexed in other sections, see:

14C-42; 19A-120-127; 19B-81; 22A-99-102-110



25 MISCELLANEOUS

25A—General

25A-62. (Book.) **Klingelnberg Technisches Hilfsbuch.** (Klingelnberg's Technical Handbook.) Ed. 12. Ernst Preger and Rudolf Reindl, editors. 762 pages. Springer-Verlag, Jebensstrasse 1, Berlin-Charlottenburg 2, Germany. 15 D. M. paperbound; 18 D. M. clothbound.

New matter in this edition includes a table of involute functions, and a section on mechanics, with additional information on moments of inertia and centers of gravity. An excellent work of reference, with numerous tables and formulas. Properties of engineering materials, metals, and nonmetals, heat treatment of metals, essential machining processes, and machine-design data.

25A-63. (Book.) **Métallurgie: Alliages Métalliques.** (Metallurgy: Metallic Alloys.) C. Chaussin and G. Hilly. 178 pages. 1948. Dunod, 92 rue Bonaparte, Paris 6, France.

A theoretical treatise covering both ferrous and nonferrous alloys. Methods of preparing constitution diagrams for binary, ternary, and quaternary systems and their interpretation. Methods of examination and investigation of ferrous and nonferrous alloys. Mechanical properties and chemical compositions of the most widely used alloys. Includes heat treatment and aging, corrosion and its prevention, and chemical analysis.

25A-64. Thirty-Fourth Annual Report of the National Advisory Committee for Aeronautics, 1948. *U. S. Government Printing Office,* 1949, 58 pages.

Technical activities including aerodynamics, propulsion, airframe construction, and operating problems research; research sponsored in scientific and educational institutions; research coordination; and distribution of information. List of committee members and financial report.

25A-65. Pile Materials: Metals, Alloys and Compounds. A. R. Kaufmann. "The Science and Engineering of Nuclear Power." Vol. II. Addison-Wesley Press, Cambridge, Mass., 1949, p. 238-248.

A brief introduction followed by sections on the metallic state; properties of alloys; phase relationships; production and manufacturing problems; fabrication of metal; analytical problems; forging, extrusion, and rolling; anisotropy of materials; and welding.

25A-66. Le frottement élémentaire. L'usure. (Elementary Friction. Wear and Tear.) Andre Marcelin. *Revue de Métallurgie,* v. 46, Jan. 1949, p. 27-35; discussion, p. 35.

Tests for investigation of lubricated and elementary friction, friction caused by alternating motion, and evolution of friction and wear. Test method and installations used.

25A-67. A Proposal for Research in Metallurgy. G. M. Foley. *Metal Progress,* v. 55, Apr. 1949, p. 503-504.

Comments critically on article of above title by M. G. Corson (Jan. issue). Recommends a more conservative approach and less tendency to rely on government support. Includes Corson's reply. The latter insists that such research will have to be done by a government agency, since no commercial organization will do it.

25A-68. Foundry Statistics. *Foundry,* v. 77, May 1949, p. 165.

Index of equipment orders, data on production workers, and on shipments and production of castings.

25A-69. Thermoelectric Experiments With Extreme-Pressure Lubricants. Robert Schnurmann. *Journal of Applied Physics,* v. 20, Apr. 1949, p. 376-383.

Requirements of lubricants. Experimental procedure. An attempt was made to calibrate thermal electromotive forces in terms of temperature. 10 ref.

25A-70. Metal Markets Undergoing Price Corrective; Does Not Signify Business Headed for Bust. Joseph Zimmerman. *Metals,* v. 19, Apr. 1949, p. 9-11, 13.

Excerpts from address by editor-in-chief, *Daily Metal Reporter.*

25A-71. ECA Program Not Likely to Have Important Impact on Domestic Producers of Metals. Evan Just. *Metals,* v. 19, Apr. 1949, p. 12-13.

Opinions of director, Strategic Materials Div., Economic Cooperation Administration.

25A-72. NACA Lowers High-Speed Flight Hurdles. Robert McLarren.

Aviation Week, v. 50, May 9, 1949, p. 21-22, 24-26, 29-30.

Aeronautical research progress of NACA during past year, on the basis of the annual report. 18 ref.

25A-73. Isotopes and Their Application in the Field of Industrial Materials. Paul C. Aebersold. *American Society for Testing Materials, Proceedings*, v. 48, 1948, p. 527-554. (Also as separate 28-page booklet at $1.00 per copy.)

Benefits derived from the application of researches in atomic science to other fields. Application of radioactive and stable isotopes; their properties, production, radioisotope measurement, facilities, and safety precautions. (1948 Edgar Marburg Lecture.) 77 ref.

25A-74. Das System Metall/Lösung als einfache Elektrode. I. Uber Zahl u. Art der Ionenubergänge am System Metall/Lösung (Metallelektrode). [The System Metal-Solution as a Simple Electrode. I. Number and Type of Ion Transfers in the Metal-Solution System (Metal Electrode).] K. Nagel. *Archiv fur Metallkunde*, v. 3, Jan. 1949, p. 33-38.

A theoretical discussion of the kinetics of ion transfer, especially with simple electrodes (electrochemical polarization). 10 ref.

25A-75. Hard Chromium-Plated Bearing Surfaces With Anti-Friction Qualities. K. Gebauer. *Engineers' Digest*, v. 10, Mar. 1949, p. 99-100. Translated and condensed from *Metalloberfläche*, v. 2, Aug. 1948, p. 161-165.

Production of small grooves or pockets by cutting or etching the base metal before plating resulted in improved frictional properties. Advantages of grooving the base metal rather than the plating, the principal one being that the plating thickness remains uniform and follows the contour of the irregularities.

25A-76. Research in the Non-Ferrous Field as Carried Out at the Research Laboratories of the General Electric Company, Limited. Ivor Jenkins. *Metal Treatment and Drop Forging*, v. 16, Spring 1949, p. 49-57.

25A-77. Role of the Mineral Industries in the National Economy. John D. Sullivan and Margaret L. Willigman. *Engineering Experiment Station News* (Ohio State University), v. 21, Apr. 1949, p. 17-25. A condensation.

Depletion of reserves and utilization of available materials. Consumption curves for common mineral reserves over a considerable period of years. Tonnage production of various industrial materials and per capita consumption of energy from various mineral fuels and water power.

25A-78. Parade of Nations. *Mining World*, v. 11, Apr. 15, 1949, p. 53-64, 66.

Foreign mineral production by country.

25A-79. Metals and Minerals Review. *Mining World*, v. 11, Apr. 15, 1949, p. 36-48.

Brief economic surveys as follows: "Lead", Henry L. Day; "Copper", James Douglas; "Silver", Roger O. Oscarson; "Manganese", "Aluminum", Floyd A. Lewis; "Gold", Joseph Stagg Lawrence; "The Atom"; "Antimony", Worthen Bradley; "Beryllium", Arthur I. Johnson; "Molybdenum", C. M. Loeb, Jr.; "Cobalt"; "Tungsten", Worthen Bradley; "Zinc", O. W. Bilharz; "Bismuth"; "Phosphates", Louis Ware; "Magnesium", L. H. Woodward; "Nickel", Robert C. Stanley; "Cadmium"; "Fluorspar", Hugh E. McCray; "Mercury", Gordon I. Gould; "Tin"; "Potash", J. W. Turrentine; "Iron"; "Titanium", Joseph H. Reid; and "Arsenic".

25A-80. 1948 Gold, Silver, Copper, Lead and Zinc Production in 12 Western States and Alaska. *Mining World*, v. 11, Apr. 15, 1949, p. 69.

25A-81. Parade of the States. *Mining World*, v. 11, Apr. 15, 1949, p. 71, 73-76, 78-79, 81, 83, 85, 87, 89, 91, 93, 95, 97, 99-100.

Survey of U. S. mineral production by states.

25A-82. Possible Markets—Ores—Metals—Non-Metallics. *Mining World*, v. 11, Apr. 15, 1949, p. 105, 107-109.

Listed under materials.

25A-83. Directory of Active Metal Mining Operations. *Mining World*, v. 11, Apr. 15, 1949, p. 112-164.

List of American mining properties is presented alphabetically by states.

25A-84. Metallurgical Considerations in the Application of Nuclear Energy for the Propulsion of Aircraft. Walter J. Koshuba. *Metal Progress*, v. 55, May 1949, p. 635-640.

Most obvious need is to develop materials that will be serviceable above 2000° F., but the problem is complicated by the necessity for these materials to satisfy nuclear requirements for a given atomic plant. Furthermore, the power plant must be light enough and small enough to be contained in a practical aircraft. How some of the metallurgical considerations will depend on the choice of atomic power plant.

25A-85. Metals for the Future. Charles Will Wright. *Engineering and Mining Journal*, v. 150, May 1949, p. 94-97.

The outlook. World production of the major base metals, prospective imports from Europe, and the work of the strategic materials division of E.C.A. Production and consumption.

25A-86. How to Choose and Use Portable Tools. Part 1. The Economic Approach. H. P. Bailey. *American Machinist*, v. 93, May 19, 1949, p. 91-93.

Method for analyzing actual costs.

25A-87. (Book) **Repertorio Della Metallurgia, Meccanica, Elettrotecnica.** (Directory of Italian Manufacturers in the Mechanical, Electrotechnical, and Metallurgical Industries.) 600 pages. Published by Societa Editrice and distributed in U. S. by E. L. Vidale, 125 W. Twelfth St., New York 11, N. Y. $6.00.

Names and addresses of 9000 manufacturers in the metallurgical, mechanical, and electrotechnical industries of Italy, classified according to products and geographical location. Indexes to the 106 product classifications are provided in Italian, English, French, Spanish, and German.

25A-88. (Book) **Chemie der Metalen.** (The Chemistry of the Metals.) Hermann Römpp. 302 pages. Uitgeverij "De Techniek", Paleisstraat, 76, Antwerpen, The Netherlands.

A semi-technical treatise in the Dutch language on the chemical behavior and properties of the metals and their respective alloys.

25A-89. (Book) **Engineering Metallurgy.** W. E. Woodward. 176 pages. 1948. Constable and Company, Ltd., 10-12 Orange St., London, W.C.2, England.

An elementary treatment designed to give the engineer sufficient knowledge for intelligent selection of metallic materials and specification of fabrication procedures. Introductory chapters on "Metals" and "Alloy Systems". Ten chapters on ferrous metallurgy, welding, Cu and alloys, Al and Mg and alloys, Ni and alloys, bearing metals, die castings, mechanical testing, and pyrometry.

25A-90. (Book) **The Mineral Industry of the British Empire and Foreign Countries: Statistical Summary** (Production, Imports and Exports), 1938-1944. 379 pages. 1948. The Imperial Institute, London.

25B—Ferrous

25B-26. A Decade of Expansion at Bethlehem's Sparrows Point Plant. T. J. Ess. *Iron and Steel Engineer*, v. 26, Apr. 1949, p. B1-B23.

Equipment, procedure, and production.

25B-27. Review of Iron and Steel Literature for 1948. E. H. McClelland. Carnegie Library of Pittsburgh, 1949, 28 pages.

Previously abstracted from *Blast Furnace and Steel Plant*. See item 25B-16, 1949.

25C—Nonferrous

25C-28. (Book.) **The First Hundred Years of the New Jersey Zinc Company.** 69 pages. 1948. New Jersey Zinc Co., 160 Front St., New York 7, N. Y.

Reviews founding and development of the company.

25C-29. Canadian Non-Ferrous Metals. A. M. Tedford. *Canadian Chemistry and Process Industries*, v. 33, Apr. 1949, p. 333-335.

A brief survey.

25C-30. 1948 Gold Production in the United States. *Skillings' Mining Review*, v. 38, Apr. 23, 1949, p. 1, 6, 9.

A statistical review by states.

25C-31. The Business of Titanium Metal. *Fortune*, v. 39, May 1949, p. 124, 126, 128.

Position of leading companies engaged in the development of titanium.

25C-32. Outlook for Slab Zinc Supply in 1949. Howard I. Young. *Metals*, v. 19, Apr. 1949, p. 7-8.

U. S. has adequate productive facilities to take care of all domestic, government stockpile, and emergency foreign needs.

25C-33. (Book) **Bibliography of the Platinum Metals, 1931-1940.** James Lewis Howe and others. 248 pages. 1949. Baker & Co., Inc., Newark, N. J.

About 7000 references arranged alphabetically by author within each of the ten years covered. Includes patent references and a subject index. Brief annotations or explanatory phrases are provided in many cases.

25D—Light Metals

25D-18. Japan's Light Metals Industry. Joseph Z. Reday. *Light Metal Age*, v. 7, Apr. 1949, p. 10-11, 32-33.

Development, present status and future prospects. Effects of SCAP controls.

25D-19. (Book) **Magnesium, Its Production and Use. Ed. 2.** Ernest V. Pannell. 189 pages. 1948. Sir Isaac Pitman & Sons, Ltd., 39 Parker St., Kingsway, London, W.C.2, England. $4.00.

Contains new information available since the removal of wartime restrictions in the period 1943-1946. The first part, dealing with the pure metal, covers general properties, sources, and methods for commercial extraction. The second part deals with alloys of magnesium and includes chapters on alloy compositions, heat treatment, casting, working, corrosion and protection, and industrial applications.

For additional annotations indexed in other sections, see:

1A-31

Something New for Designers and Metals Engineers

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280. Bearings, Bronze

New 16-page booklet No. 3 lists hundreds of sizes and types of Compo oil-retaining bearings along with additional data on formulas, tolerances and specifications. Bound Brook Oil-Less Bearing Co.

281. Blackening Process

Literature on procedures now available in new tumbling techniques for blackening and coloring. Enthone Inc.

282. Castings, Beryllium Copper

Bulletin 11 entitled "Beryllium Copper Investment Casting" gives full data for the first time on economical use of precision-cast beryllium copper for industrial parts. Beryllium Corp.

283. Core Baking

Two new data sheets outline the fundamentals of electronic core-baking and describe how the new resin binder is used to great advantage. New data sheets will follow each month. Induction Heating Corp.

284. Electrodes, Container

Announcing a new Arcaloy AC-DC stainless electrode and new all-steel, moisture-proof and grease-proof container. Packed in containers made to simplify stock problems, these new electrodes produce the cleanest welds in the industry. Alloy Rods Co.

285. Gas Burners

Bulletin 58 describes, with burner charts and drawings, certified combustion made possible with new series of gas burners. North American Mfg. Co.

286. Gas Pumps

Bulletin 32-33-B-13 gives full details on Rotary Positive Gas Pumps, illustrating four standard types with sectional drawings and photos of typical installations. Roots-Connersville Blower Corp.

287. Hardening, Flame

Latest copy of Tempil Topics gives a concise summary of the flame hardening process. Tempil Corp.

288. Hardness Tester

New Kentron micro hardness tester described in bulletin K-49, along with other important testing aids such as the Knoop and Diamond Pyramid Indenters. Kent Cliff Laboratories

289. Heat Treating

Five booklets now available describe fully with interesting illustrations the different heat-bath processes including carburizing, tempering, and a superior black finish. Heatbath Corp.

290. Laboratory Equipment

Literature available on four new developments in laboratory equipment, including new 2400° lab furnace, semi-automatic and precision carbon determinators and series of combustion boats. Laboratory Equipment Corp.

291. Metal Engineering Data

New 8-page bulletin gives engineering data including load deflection, air flow comparison, and free openings of both standard and flattened mesh types of expanded steel. Jos. T. Ryerson & Son, Inc.

292. Press, Hydraulic

Straightening, forming, broaching and assembling operations all competently and economically handled by the new hydraulic metalworking press just developed. Niagara Machine & Tool Wks.

293. Surface Control

New 8-page bulletin gives numerous practical advantages of shop control for surface roughness and waviness. Write for "More Profits to You Through Surface Control". Physicists Research Co.

294. Tube Furnace

New electric tube furnace especially designed for general research work. Materials can be tested to maximum temperature and cooled quickly. Bulletin gives full description and also typical heating and cooling curves. Harper Electric Furnace Corp.

295. Universal Tester

New Multi-Low - Range universal tester. Bulletin M gives full description of operation with photographs of all parts. W. C. Dillon & Co.

296. Valves

Bulletin 711 includes the latest information on forged steel relief valves, designed for basic steam, oil or vapor working pressure of 600 lb. at 850° F. Edward Valves, Inc.

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Metals Review, June 1949

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279	281	283	285	287	289	291	293	295
280	282	284	286	288	290	292	294	296

Circle these numbers for information about new products described on pages 60 through 63.

822	824	826	828	830	832	834	836
823	825	827	829	831	833	835	

This coupon is void after Sept. 15, 1949

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MAIL TO METALS REVIEW, 7301 EUCLID AVE., CLEVELAND 3, O.

EMPLOYMENT SERVICE BUREAU

The Employement Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.

POSITIONS OPEN

EAST

METALLURGICAL SALES DEVELOPMENT: Attractive and responsible position in Chicago for a graduate metallurgical engineer, 32 to 38 years old, who has had experience in the processing and application of alloy steel. Box 6-5.

RESISTANCE WELDING ENGINEER: Excellent opening for engineer with resistance welding background, interested in research or development in this field. Prefers man with advanced college training but not essential. Should be able to initiate and execute over-all research program. Metals Dept., Armour Research Foundation, Chicago 16, Ill.

STEEL MILL RESEARCH METALLURGIST. Excellent opening for metallurgist having blast furnace or openhearth experience interested in research on steel melting techniques. Advanced college degree desirable but not essential. Should be able to initiate and execute over-all research program. Metals Dept., Armour Research Foundation, Chicago 16, Ill.

RESEARCH SCIENTISTS: Experienced research scientists with advanced degrees and experience in physics, aerodynamics, thermodynamics, electronics, optics, mathematics, chemistry, metallurgy, or meteorology to perform supervisory research and act as permanent consulting group to engineering laboratories. Excellent opportunity for men with right qualifications. Salary, $8000 to $14,000. Box 6-10.

METALLURGICAL ENGINEER: Recent graduate to begin extensive training in manufacturing, production control and foundry operations in this country and abroad. Position will eventually lead to top management of foundry operations. Box 6-130.

WEST COAST

DISTRICT SALES MANAGER: Pacific northwest. Knowledge of electric welding. Willing to travel extensively in own car. Working with and educating distributors selling nationally known steel products for maintenance and repair of construction, mining, quarry equipment. Salary and commissions. Write qualifications. Box 6-135.

MIDWEST

RECENT GRADUATE ENGINEER: Established producer of foundry materials seeks young metallurgical or mechanical engineer to contact foundries in Midwest. Sales and service. Background in foundry sand and melting practices desirable. Salary. Box 6-140.

POSITIONS WANTED

METALLURGIST: B. Met. E. and M.S. degrees. Age 28. 4½ years' experience in heat treating, tool hardening, physical testing, specification of materials and heat treatments, literature research, report writing and foundry control. Desires position in production or development work. Box 6-15.

JUNIOR METALLURGIST: For production or heat treating department. 1½ years' experience. B.S. from Notre Dame. Age 23, married. Prefers north New Jersey area. Box 6-60.

METALLURGIST: B.S. from M.I.T. M.S. from midwestern university in August. Age 29, married. Interested in teaching, or academic or industrial research position. Some research and ten years' machine shop experience. Box 6-25.

METALLURGIST-CHEMIST: Seeks a technical position. Seven years experience in application and control of stainless steels, toolsteels, supervision of heat treat operations, metal fabrication, protective coatings, and research work in ferrous and nonferrous alloys. Seven years college training. Age 38, married. Willing to travel and immediately available. Excellent references. Box 6-30.

RESEARCH METALLURGIST: Age 34, Met. Eng. degree, married. Ten years of diversified experience in metallurgical research and development. Currently in complete charge of all basic research on steels at a large research laboratory. Numerous publications. Desires position as chief metallurgist, research director or research metallurgist in a small or medium sized concern. Box 6-35.

ENGINEER: Age 37. 13 years diversified experience in engineering and production in chemical and mechanical fields. Wide knowledge of mass production of small precision parts and assemblies. Desires position of chief or assistant chief engineer or production superintendent or assistant in progressive small or medium sized company. Box 6-40.

ENGINEER: Seeks position to utilize combination of chemical engineering education and metallurgical experience. Honor graduate, B.S. Graduate studies. Active in social, fraternal, honorary societies. Development experience, metals casting, processing, testing. Group leader status. Excellent record. Available late fall. Box 6-45.

SALES MANAGER OR ASSISTANT: Nonferrous mill or warehouse field. Experienced in nickel alloys and aluminum. Two years district manager of national aluminum manufacturer for 12-state area. Four years assistant sales manager for 4-state area. Prefers Midwest or South. Age 40, married, college education. Box 6-50.

METALLURGICAL ENGINEER. B.S. in metallurgical engineering at Lehigh University. Age 29, married. Two years' experience in magnesium alloy melting and casting. Three years' experience in alloy, stainless, tool, and high speed steel heat treating and melting. Interested in work leading to operating or production metallurgy. Box 6-55.

MANUFACTURERS' AGENT: 23 years' experience selling production materials to manufacturers in Ohio, Michigan and adjacent areas of New York, Pennsylvania and Indiana. Now selling nonferrous wire and limited line of tungsten and molybdenum products. Familiar with electrical contacts and can handle a line of tungsten or silver. Will consider any established complementary lines. Box 6-20.

METALLURGICAL ENGINEER: Single, age 27. B.S. in metallurgical engineering. Experience in physical metallurgy (ferrous and nonferrous), resistance welding, heat treating and metal fabrication. Desires position as technical salesman or customer service contact man. Will travel. Has good job, but now looking for a better one. Box 6-65.

METALLURGICAL ENGINEER: B. Met. E. from Polytechnic Institute of Brooklyn, June 1949. Comprehensive training in physical metallurgy of ferrous materials, and some nonferrous. Research experience in heat treatment of ferrous materials. Interested in position of production or research and development metallurgist. Location East or Midwest. Box 6-70.

METALLURGISTS

Leading electronics manufacturer located on Long Island has need for metallurgists for development and research work on non-ferrous alloys for electrical applications. Persons able to combine theory and practice desirable. Salary dependent upon education and experience. Write Box AMR 1100, 222 W. 42 St., N. Y. 18.

ENGINEER: Extensive knowledge of materials, broad experience in manufacturing and fabricating methods, work simplification and materials conservation. Wants position as sales or application engineer developing new methods. Would be particularly interested in development of welded or brazed assemblies as replacements for castings, forgings or complicated machined parts. Prefers West Coast. Box 6-75.

METALLURGICAL ENGINEER: Age 34, married. B.S. in metallurgical engineering. Ten years' diversified experience in investigation of failures, contact work, heat treatment, research and development in ferrous and nonferrous materials, report writing, supervision and sales. Midwest area preferred. Box 6-80.

SALES OR PERSONNEL WORK: B.S. in chemical engineering, University of Illinois, 1942. Veteran. Three years with air conditioning and heating manufacture, supervisory position. Experienced in lubricants, metals, corrosion, metal fabrication and assembly, cost reduction studies, and laboratory work—chemical and metallurgical. Age 28, salary $5500. Box 6-85.

METALLURGIST: D. Eng. 1949. Graduate of several universities. Desires position as college professor in metallurgy and/or mining. Young, married. Five years of varied experience in the mineral industries and in teaching metallurgy and allied subjects. Several years of fundamental research. Box 6-90.

INDUSTRIAL ENGINEER: Desires position with a company interested in cost reduction through the use of wage incentives and the coordination of tool and methods work. Age 38, married, B.S.M.E. degree, registered professional engineer in the State of Missouri. 15 years' experience in cost reduction work. Box 6-95.

METALLURGICAL ENGINEER: Married. M.S. in metallurgy from Stevens Institute of Technology, 1948. Thesis in powder metallurgy. Experience in laboratory and production. 12 years in ferrous and nonferrous metals industries. Four years at research laboratory. Desires position in East. Complete resumé of experience on request. Box 6-100.

METALLURGICAL SALES ENGINEER OR HEAT TREAT SUPERINTENDENT: 12 years' diversified experience of supervisory capacity in ferrous metallurgy heat treating, metallography and physical testing laboratory work. Has done consulting, trouble shooting, and development work. Three years' experience as metallurgical sales engineer directing tool and die steel and specialty steel sales. B. Sc. degree. Age 40, married. Box 6-105.

PRODUCTION METALLURGIST: Met. E. 1939, M.S. 1947. Age 33, married. Melting, supervision and metallurgical experience involving cupolas, converters, electric furnaces, openhearths, rolling mills, steel and iron foundries. Supervision of chemical, physical and sand laboratories. Well versed in statistical quality control Box 6-110.

SALES ENGINEER: B.S., age 46, married. Will travel or relocate. Experienced selling all heat treat items, salts, oil. Also black finishes, welding and induction units. Northern Ohio preferred. Box 6-115.

SALES OR PRODUCTION: June graduate, B. of Met. E., R.P.I. Married, two children, age 29, veteran. Looking for position where can settle down to become active, useful member of the community. Training in ferrous metals; interest in basic or fabricating industry. Salary $3600. Midwest or west. Box 6-120.

WELDING ENGINEER: Mechanical engineering graduate. Experience includes field engineering, sales promotion, research and plant welding supervision. Low-carbon and stainless steels, nickel, copper and aluminum alloys. Metallic, carbon and inert-gas arc, submerged arc, oxy-acetylene and resistance welding. Presently located in southern California but will go anywhere. Box 6-125.

Quarter-Century Club Adds New Members

The following A.S.M. members have been awarded honorary certificates commemorating 25 years' consecutive membership in the society:

Baltimore Chapter — Emil Gathmann, George Nauss.

Boston Chapter — Cape Ann Tool Co. (William J. Dean, representative on sustaining membership), J. Edward Donnellan; General Alloys Co. (H. H. Harris, representative), Hartel Brothers Co. (A. Hartel, III, representative), Greswold Van Dyke; (L. D. Hawkridge, representative), Houghton & Richards, Inc. (J. S. Flynn, representative), New England Metallurgical Corp. (A. D. Bach, representative), Greswold Van Dyke, Walworth Co. (W. Patscheider, representative), Ward Steel Co. (J. A. Parsons, representative), Wheelock-Lovejoy & Co., Inc. (A. Oram Fulton, representative).

Chicago Chapter — F. E. Clark, Ralph E. Cramer, J. H. Hruska; International Harvester Co. (R. E. McGee, representative), S. C. Massari, S. S. Montgomery; Westclox Division, General Time Instrument Corp.

Cincinnati Chapter — Walter D. Archea, Carl W. Bieser, Wm. L. Boehme, J. W. Bolton, Cincinnati Bickford Tool Co. (George P. Gradolf, representative), Cincinnati Milling Machine Co. (Hans Ernst, representative), H. E. Friedlein, Anson Hayes, Reid L. Kenyon, Wilson Kinsey, W. R. Klinkicht, Murrer Tool Co. (H. C. Murrer, representative), L. F. Nenninger, Newport Steel Corp. (Charles H. Stamm, representative), Ohio Knife Co. (H. E. Waldo, representative), Elmer F. Ries, Louis G. Robinson, N. M. Salkover, Bernard H. Stenger, E. P. Stenger, D. M. Strauchen, Tool Steel Gear & Pinion Co. (Leroy Brooks, Jr., representative), Robert F. Uihlein.

Detroit Chapter—Harry J. Askew, J. W. Barnett, Edmund Blasko, W. J. Burr, L. B. Case, Glenn Coley, D. R. Dale, A. C. Dames, C. N. Dawe, J. H. Dunbar, Edgar D. Flintermann, E. H. Graham, William H. Graves, Jr., Robert K. Greaves, C. G. Heilman, C. E. Hellenberg, E. J. Hergenroether, L. G. Hulbert, H. O. Lang, R. E. Lauer, J. H. McCadie, J. L. McCloud, Thomas A. Moorman, T. R. Navin, F. R. Nethaway, Alfred Nicholls, W. S. Nunemaker, I. Olsen, John D. Paterson, C. B. Phillips, I. S. Reid, J. W. Robinson, Robert Sergeson, H. L. Shippy, F. J. Sikorovsky, C. W. Sinclair, E. M. Slaughter, A. J. Smith, Stanley Sowder, Scott C. Taylor, E. W. Upham, C. Upthegrove, F. J. Walls, J. M. Watson, A. E. White, W. H. White, S. L. Widrig, William P. Wood, F. Lloyd Woodside, W. P. Woodside, F. P. Zimmerli.

Eastern New York Chapter—E. J. Edwards, C. H. Hannon, W. F. Hodges, F. B. Lounsberry, R. F. Newell, Mortimer F. Sayre, T. C. Sherman, William R. Whitney, H. H. Zornig.

Hartford Chapter — Collins Co., Hartford Electric Light Co., Hartford Gas Co., Whitney Mfg. Co. (all sustaining memberships).

Lehigh Valley Chapter—Bethlehem Steel Co., H. S. Brainard, G. O. Carlson; Carpenter Steel Co., M. W. Dalrymple, B. H. DeLong, Samuel Epstein, Thomas G. Foulkes, J. L. Gregg, Samuel T. Harleman, W. C. Hartmann, J. K. Killmer, Howard S. Lewis, G. V. Luerssen, Stewart E. Printz, B. F. Shepherd, C. C. Sickels, A. P. Spooner, J. H. Stoll, Bradley Stoughton, J. M. Sylvester, H. F. Weaver.

Los Angeles Chapter — W. A. Abegg, A. R. Foster, Walter G. Hildorf, J. Max Lee, A. Naish, B. Reinhold, Rolland H. Soll.

Milwaukee Chapter — William A. Beimling, E. O. Dixon, Muir L. Frey, J. Fletcher Harper, Joseph F. Hushek, John A. Mirzejewski, Chester S. Moody, Adam E. Rauch, Bert F. Reed, C. F. Schwan, Albert A. Schuetz, James Sorenson, R. J. Thurner, Charles I. Wesley, Wesley Steel Treating Co., Clifton W. Windfeldor, Emanuel Yunk.

Pittsburgh Chapter—F. H. Allison, Jr., E. C. Bain, C. E. Carlson, C. E. Corson, E. H. Dix, Jr., J. H. Flaherty, C. E. Loos, Ewart S. Taylerson, Alan Terrile.

New Haven Chapter—Eastern Machine Screw Corp. (E. O. Williamson,

Rochester Chapter — William J. Conley, Guy Hoghtaling, H. J. LeClaire, I. C. Matthews, Fred F. Stein. representative).

St. Louis Chapter—John M. Acee, Granite City Steel Co. (sustaining membership represented by F. G. White), Allan Jackman, Fred W. Oches, William J. Ruby, F. E. Schwentler, G. B. Swander.

WANTED!

One copy of Massachusetts Institute of Technology Proceedings of Special Summer Conference on Friction and Surface Finish, 1940. Please contact Federal-Mogul Research & Development, 2355 Stadium Blvd., Ann Arbor, Mich.

FOR SALE

BALDWIN LOCOMOTIVE WORKS UNIVERSAL HYDRAULIC TESTING MACHINE, Model S-10-C. Dual range capacities: 0 to 4,000 lbs. and 0 to 20,000 lbs. Cost $1,900.00. Condition equal to new. Will sell for $1,100.00.

BONDED RESISTANCE WIRE STRAIN GAUGE equipment as follows:

1—Baldwin Southwark SR4 Portable Strain Indicator

1—Baldwin Southwark 20 channel SR4 Bridge Balancing Unit.

Both instruments in perfect condition. Approximate cost $900.00. Will sell for $500.00.

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Write to Metals Review for free copy of the address list

METALS REVIEW

7301 Euclid Ave. **Cleveland 3, Ohio**

NEW PRODUCTS *in Review*

822. Aluminum Alloy

A new aluminum alloy designated as 150S, developed by Permanente Metals Corp., is the first general-purpose specification alloy to be introduced in 20 years. Its combination of properties is intermediate between the popular common alloys 3S and 52S.

While alloy 150S is expected to be of particular interest to refrigeration, appliance, utensil and building materials manufacturers, it has also been successfully tested for the fabrication of such widely diversified products as vending machine parts, irrigation pipe, fruit lugs, wheelbarrow trays and store shelving.

Its yield strength is intermediate between 3S and 52S. Workability is approximately equal to that of 3S, finishing characteristics and corrosion resistance are superior to 3S, and welding and brazing characteristics of the alloy are intermediate between 3S and 52S. Alloy 150S is available in six tempers (designated SO, H22, H32, H34, H36, and H38) with varying degrees of formability and strength.

The improvement in strength and finish of a product made of 150S as compared to the same article made of 2S or 3S is expected, in most instances, to outweigh the slight increase in material cost. In many applications the higher strength will permit a slight gage reduction and actual lowering of material costs.

For further information write Vance Fawcett, Permanente Products Co., 1924 Broadway, Oakland 12, Calif., or use coupon on page 57, circling No. 822.

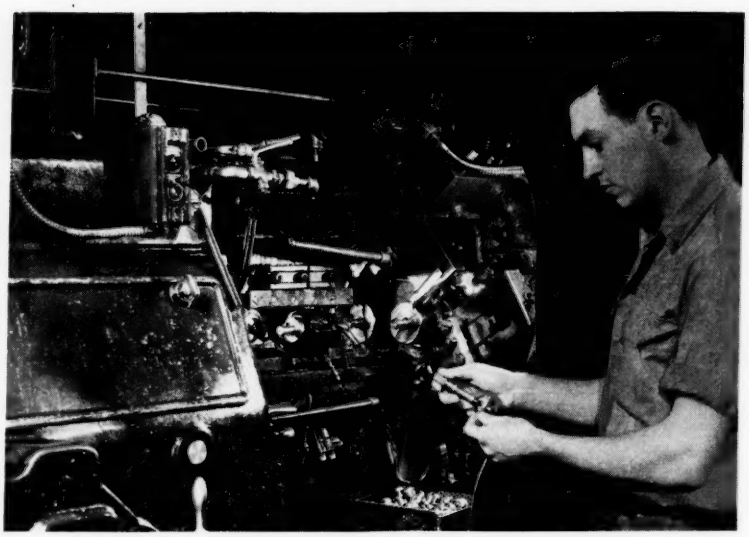
823. Rigidized Metal Tubing

Rigidized metal tubing is now available to furniture and display equipment manufacturers. The textured finish of the Rigidized tubing hides surface scratches and is said to be less expensive to plate because it does not require polishing. Stronger than plain metal sheet, Rigidized metal resists marring during fabrication. Further cost savings are effected because lighter gages can be used.

Rigidized metal patterns produce a tubing which is more attractive in appearance than plain metal, and one which provides a longer service life, free from scratches and other evidence of wear.

For further information write Lee Hogan, Standard Tube Co., 24400 Plymouth Rd., Detroit 3, Mich., or use coupon on page 57, circling No. 823.

824. New Free-Machining Screw Steel



Production of nuts, studs, fittings, and other machined parts on equipment such as this six-spindle automatic screw machine has been increased from 10 to 25% when Jones & Laughlin's new "S" steel was used in exhaustive field tests to replace the fastest machining bessemer screw stock previously used. Production increases are accounted for by faster machine speed and less downtime for tool changes. "E" steel can be furnished in cold finished bars. It also has a smoother finish after machining, and better cold working and cold forming properties. For further information write John Timberlake, Jones & Laughlin Steel Corp., Pittsburgh 30, Pa., or use coupon on page 57, circling No. 824.

825. Hardening High Speed

A lithium high speed furnace is now available for heating molybdenum, tungsten and cobalt steels to maximum hardness right out of the quench. It is said to be the only direct-fired furnace that does the job without producing a soft skin, decarburization or scale.

The furnace is built to operate at temperatures from 1400 to 2475° F., and is equipped with the lithium atmosphere vaporizer for complete protection of the work. It can be direct-fired by either gas or oil and has no muffle, therefore requiring less operating and maintenance expense.

It is particularly adaptable for heating such high speed steel products as taps, dies, reamers, drills, broaches, and saw blades. Three types are available in various sizes: (*a*) single chamber for high heat, (*b*) double chamber for preheat and high heat, and (*c*) triple chamber for preheat, high heat and salt quench.

For further information write Harold J. Ness, The Lithium Co., 111 Sylvan Ave., Newark 4, N. J., or use coupon on page 57, circling No. 825.

Apologies

To Hanson-Van Winkle-Munning Co., to Sturgis Products Co., and to our readers, for the mix-up in photographs which occurred on page 63 of the April issue of *Metals Review*. The photograph accompanying item No. 840 is not a Mercil-type burnishing barrel made by Hanson-Van Winkle-Munning Co., but is the Roto-Finish eight-door machine made by Sturgis Products Co.

826. Hardening Compound

Hardening drills, chisels, gouges, caulkers, reamers, dies, taps, and other cutting tools to any desired depth in minutes is now possible with a new compound called "Hi-Speed-It". It can be used on any carbon or high speed steel.

Ordinary wire nails and common reinforcing rods hardened this new

After Hi-Speed-It Treatment, an Ordinary 20-Penny Nail Cuts Into an Automobile Leaf Spring

way can be driven through a tough automobile spring leaf with no apparent dulling. Dime-store chisels become so hard they cut nicks in chromium-manganese railway rails. In a recent test, a 1½-in. gage was deep hardened in 3 minutes. It was at once put into an air hammer, and cut, without stopping, four strips from a piece of Type 302 stainless steel. The strips were 5/16 in. deep by ⅜ in. wide by 14 in. long.

The process is simple and requires no special skill nor special equipment. The object to be hardened is first heated to a cherry red in an ordinary plumber's torch or an open forge or furnace. It is then dipped, rolled or stirred in the gray powder. After allowing 15 to 30 sec. for the powder to fuse and form a crust, the object is again dipped lightly in or sprinkled with "Hi-Speed-It". It is reheated cherry red, and then quickly quenched in cold water or brine.

Depth of hardness is controlled by repeating the first four steps before quenching. High speed steels are processed similarly, but at higher temperatures and are quenched in oil. "Hi-Speed-It" contains no cyanide or other toxic substances.

For further information write the Wilson Carbon Co., Inc., 60 East 42nd St., New York 17, N. Y., or use coupon on page 57, circling No. 826.

827. Zinc-Coated Steel

A fourth major unit for continuous production-line coating of flat-rolled steel in a bath of molten zinc or aluminum has been put into operation by Armco Steel Corp. The special zinc-coated product is sold under the trade name "'Armco Zincgrip", and the aluminum-coated sheet is known as "Armco Aluminized". With the installation of the fourth huge unit at the Middletown plant, the patented coating process will be offered to other steel companies under license arrangements with Armco.

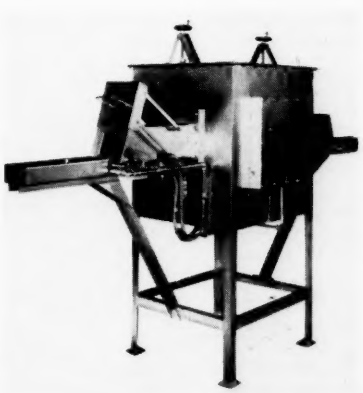
The method of coating is entirely different from that used in standard galvanizing practice, in which steel is simply passed through a bath of zinc. Under the Armco process, cleaned strip steel enters a furnace with controlled atmosphere consisting mostly of a mixture of hydrogen and nitrogen with air essentially excluded. Here the surface of the strip is made ready for its journey through the bath of molten zinc. Here, too, the steel is annealed and softened.

Unlike regular commercial galvanized sheets with the same weight of coating, Zincgrip can be severely formed or drawn without flaking or peeling of the zinc. No coating operations are necessary after fabrication. Exposure tests of stock specimens to various industrial and seacoast atmospheres over a period of six years indicate that the specially applied zinc coating has greater atmospheric corrosion resistance than coatings on regular galvanized sheets.

For further information write Harry V. Mercer, Armco Steel Corp., Middletown, Ohio, or use coupon on page 57, circling No. 827.

828. Electric Furnace

A new electric furnace, known as Pereco Model SNX, is designed specifically for use in sintering powdered metals, brazing, bright annealing and for many other metallurgical research problems. Normal heat range is 1400 to 2500° F. with flash firing to 2750° F.



Heated by Globar elements, the furnace is of the manual pusher type, designed for batch treatment on a straight-line three-zone system. The work moves from the purge, or preheat chamber, through the high-temperature area, and then through the water-cooled cooling zone. Both doors are counter-balanced and are equipped with automatically operated flame curtains which prevent contamination of the furnace atmosphere when the doors are open.

Gas-tight construction is used throughout, with connections provided for introduction of controlled atmospheres. Most types of atmospheres may be used except those few which attack the Globar (silicon carbide) elements.

For further information write Andrew Pereny, Pereny Equipment Co., 893 Chambers Rd., Columbus 12, Ohio, or use coupon on page 57, circling No. 828.

829. Hardness Test Blocks

As part of a complete line of hardness testing equipment, Clark Instrument, Inc., has announced a series of precision test blocks. These blocks

are held to extremely close tolerances and have an exceptionally fine finish. While specifically manufactured for use with Clark testing machines, they give accurate results on any Rockwell type hardness tester. The test blocks are available in hardness grades for all Rockwell scales, and the limits covered by each block are clearly stamped on the edge.

In addition to these standard test blocks, the company makes a deluxe Master Diamond Checking Set. This includes a gold plated diamond penetrator and two test blocks—one for the higher and one for the lower range of hardness values. The diamond penetrator is intended for use only when checking the owner's machine, thus assuring accurate test readings. An upholstered, leather-finished case protects the penetrator and test blocks when not in use.

For further information write C. L. Clark, Jr., Clark Instrument, Inc., 10200 Ford Rd., Dearborn, Mich., or use coupon on page 57, circling No. 829.

when you need "spillage" protection

it's the

LINDBERG

LABORATORY HOT PLATE

The Lindberg Hot Plates have the built-in spillage protection that the baby kissin' politician *wishes* he had.

Maximum protection from corrosion, discoloration and hazards caused by spillage of liquids and chemicals onto the heating element is a built-in feature of the specially "metalized" top plate. The special ¼" metal top plate resists growth and warpage . . . rounded edges and apron protect underlying elements . . .

Coiled nickel-chromium elements heat the entire top uniformly from 130° to the continuous operating peak of 950° F. (54 to 510° C.) . . . **simple, stepless temperature control to any degree of heat within the working limits is supplied by the exclusive Lindberg Input Control.**

All parts of the unit are protected by heavy insulation and sheet steel. All instruments and controls are built-in . . . ready for one connection to the power source. Smooth button supports prevent the unit from disfiguring its supporting surface. Units are carefully packed and individually shipped.

Ask your laboratory equipment dealer for full details, or write Lindberg Engineering Company, 2442 West Hubbard Street, Chicago 12, Illinois. *Ask for Bulletin 962.*

LINDBERG—*for a complete line of the finest*
LABORATORY HEATING APPARATUS

NEW PRODUCTS *in Review*

830. Fast-Cutting Bessemer Steel

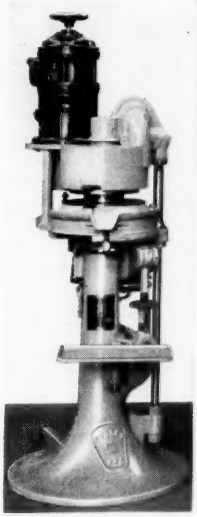
A new bessemer steel bar stock, called USS "MX" free-machining steel has been announced by Carnegie-Illinois Steel Corp. When used in automatic screw-machine operations, "MX" steel provides substantially longer tool life and greatly improved surface finish of parts with up to 20% increase in machinability over standard bessemer steel bar stock of comparable grade.

"MX" free-machining steel has been developed specifically to augment the machining characteristics of Grade B-1113 steel in many applications. The new steel also performs well in subsequent operations such as forming or crimping the machined parts. It has been used successfully on extensive production test runs in the manufacture of automatic screw-machine parts.

"MX" steel is available in hot rolled bars from Carnegie-Illinois Steel Corp., and in cold finished forms from cold finishing plants.

For further information write Robert J. Wilcox, United States Steel Corp. Subsidiaries, 429 Fourth Ave., Pittsburg 19, or use coupon on page 57, circling No. 830.

831. Powder Metal Press



A special high-speed rotary compressing machine is designed for handling abrasive materials such as powdered metals, powdered glass, and ceramics. Compressed parts up to ½ in. diameter can be produced at rates up to 300 parts per min. This Stokes B-2X press can compress a wide assortment of shapes and sizes, including parts having cored holes.

With a 1-hp. gearhead motor mounted vertically above the die area of the press, the possibility of abrasive material working into and damaging the motor is eliminated. Special guards protect the upper punches from excessive wear. The press applies up to 2½ tons pressure from above and below simultaneously.

For further information and specifications write F. J. Stokes, F. J. Stokes Machine Co., 5977 Tabor Rd., Philadelphia 20, Pa., or use coupon on page 57, circling No. 831.

832. A. C. Arc Welders

A new line of a. c. arc welders features increased welding range and stepless precision current control. They are available in 200, 300, 400, and 500-amp. models for indoor manual welding; 750 and 1000-amp. models for machine and submerged melt welding; and a special 200-amp. model for light-duty, job-shop welding. The 300, 400, and 500-amp. models are offered also in weather resistant enclosures with Idlematic control for both indoor and outdoor operation.

Dual current ranges and increased adjustment overtravel provide extra low current range with high maximum short-time output. The new machines are designed with stepless current control, operated by a bearing-mounted current-adjustment crank which enables the operator to make precision settings throughout the current range.

The new welders have an open-circuit voltage of 75 volts, providing good welding performance through added arc stability. Increased strength and protection for the welders are provided by the newly designed steel housings.

For further information write C. I. MacGuffie, General Electric Co., Schenectady 5, N. Y., or use coupon on page 57, circling No. 832.

833. Laboratory Muffle Furnace

A revolutionary new design in laboratory furnace construction has been introduced by Hevi Duty Electric Co. The furnaces are intended for general laboratory requirements

such as drying of precipitates, ash determinations, fusions, ignitions, heating metals and alloys, enameling and ceramic firing, heat treating and general experimental work.

Departing from the usual rectangular shape, the new muffle furnace is housed in a cylindrical shell mounted on a pyramidal base. Thus air can circulate freely around the furnace and heat is not trapped in the base. Among the many advantages are that:

1. Instruments and controls are at approximately room temperature.

2. Improved insulation design cuts radiation loss.

3. A Hevi Duty tap-changing transformer provides 36 steps of control.

4. Recessed position of controls affords full protection.

5. Instruments are easily accessible through removable panels. Multiple replaceable heating units have been retained in the new design.

For further information write Arthur Oberndorfer, Hevi Duty Electric Co., Milwaukee 1, Wis., or use coupon on page 57, circling No. 833.

834. Cleaner for Aluminum

A new cleaning bath is effective on aluminum parts that are heavily coated with polishing composition, especially in recessed areas. Soil is completely removed without scrubbing. The bath is composed of 2 to 4 oz. per gal. of Alkalume #1 plus 2% by volume of Liquid Stripper #2. Work is immersed for a period of 2 to 5 min. at 160 to 190° F., temperature depending upon the transfer time. This is followed by a thorough rinse of the free-flowing or spray type.

The operation is preliminary to the conventional painting, anodizing or plating cycle and may be carried out in manual or automatic equipment where cleaning is by immersion.

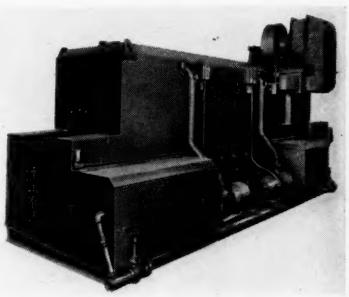
For further information write H. J. McCracken, Northwest Chemical Co., 9310 Roselawn Ave., Detroit 4, or use coupon on page 57, circling No. 834.

835. Spray Washer

A series of new metal parts washers features standardized construction so that multiple wash, rinse and dry-off stages may be incorporated at minimum cost. They are designed so that if only spray stages are installed originally, a blow-off stage may be readily added at any later time.

These machines—the WB-100-S, single-spray-zone unit and the WB-200-S, two-spray-zone unit—may be used as standard metal parts washers for ordinary alkali cleaning compounds, or may be easily converted in a matter of minutes to handle those compounds which have a tendency to foam excessively.

The work is pressure-sprayed with cleaning solution from rigidly supported multiple spray headers. Spray nozzles are readily accessible for cleaning, and are adjustable so that they may be directed to any given



point, top, bottom and sides. All spray headers are provided with removable plugs for easy cleanout.

For further information write George W. Walter, Detrex Corp., 14331 Woodrow Wilson Ave., Detroit 32, Mich., or use coupon on page 57, circling No. 835.

836. Forging Press Installed

A new 1500-ton steam-operated hydraulic press for breaking down steel ingots into billets and various rounds and flats has recently been put into operation at the mill of Jessop Steel Co., manufacturer of stainless steel, saw steel, toolsteel, and other specialty steels.

Much of the work now done on the new forging press was previously turned out in the blooming mill. Use of the forging press will result in substantial savings in time, in ingot mold costs, and in grinding

costs. Furthermore, there is less chance for checks or cracks on the surface of the steel when it is worked in the forging press.

Auxiliary equipment for the new press includes two large soaking pits for heating the ingots prior to forging, a large "manipulator" for holding the ingots during the forging operation, and a large reheating furnace. The soaking pits have concrete walls with a "Pyrofac" lining so that repairs on the inside of the pit walls can be quickly made without the long cooling period required by a refractory brick lining.

For further information write Frank B. Rockley, Jessop Steel Co., Washington, Pa., or use coupon on page 57, circling No. 836.

ADVERTISERS INDEX

Alox Corp.	31
Armour Ammonia Works	45
Burrell Technical Supply Co.	37
Electric Furnace Co.	43
Holden Co., A. F.	Front and Back Covers
Institute of Metals	38
Laboratory Equipment Corp.	38
Lindberg Engineering Co.	62
Ryerson & Son, Inc., Jos. T.	19

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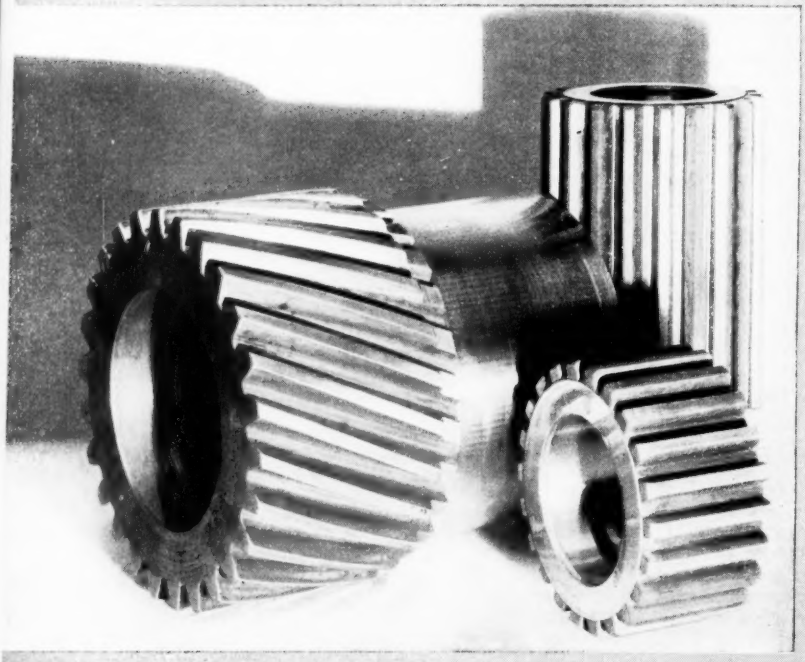

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